2006 Performance Report

General Chemistry and Microbiology Section

July, 2007

Protecting our environment.

Ontario

2006 PERFORMANCE REPORT

GENERAL CHEMISTRY AND MICROBIOLOGY SECTION

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Laboratory Services Branch

Ontario Ministry of the Environment

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INTRODUCTION

The General Chemistry and Microbiology Section (GCMS) is part of the Ministry of the Environment's Laboratory Services Branch. The section is comprised of two units, the Water Chemistry and Microbiology Unit. The Water Chemistry Unit identifies and provides quantitative analysis for major ions, nutrients, and physical properties in a variety of matrices. The Microbiology Unit identifies and enumerates indicator bacteria of water and waste waters.

This report provides a brief outline of the analytical quality control (QC) program associated with sample analysis and examines 2006 performance data for each test in the Water Chemistry and Microbiology Units. GCMS strives to maintain a high standard of analytical performance through its quality assurance program. QC is an integral part of this process.

Some changes have taken place in the General Chemistry and Microbiology Section since the 2006 performance report was issued. The following describes those changes.

METHOD IMPLEMENTED BY GCMS in 2006

Cryptosporidium parvum and Cryptosporidium hominis (E3463)

METHOD ANALYTICAL RANGE CHANGED BY GCMS IN 2006

Nitrate + Nitrite (E3364)
Analytical range was changed from 0 – 5 mg/L to 0 – 12.008 mg/L

Bromate (E3434)
Analytical range was changed from 0 – 15 µg/L to 0 – 30 µg/L.

Bromide (E3434)
Analytical range change from 0 – 30 µg/L to 0 – 300 µg/L

NOTE

The Water Chemistry Unit under went renovations that required the shut-down of the laboratory from March 3, 2006 until May 31, 2006.

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1.0 PERFORMANCE REPORT FORMAT

The parameters are those analysed by the GCMS for 2006.

The performance report is organized alphabetically according to test name (eg. Dissolved Organic Carbon is filed under the heading "Carbon, Dissolved Organic") and second, by the method reference number. Detailed information concerning the format of each page is outlined below:

1.1 TEST DESCRIPTION

TITLE: The name of the test parameter

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status: Identifies if the parameter is accredited

Licensed (Drinking-Water): Identifies if the parameter is licensed under the Ontario Safe Drinking Water Regulation O.Reg.248/03

Reportable Limit: Identifies the reportable limit associated with the Ontario Safe Drinking Water Regulation O.Reg.169/03

Refer to LSBSOP.031 & LSBSOP.039 for further explanation on the procedures for drinking-water analysis.

IDENTIFICATION:

Laboratory: Location where the test is performed.

Method Reference No: A number assigned by the Quality Management Unit to an analytical test method (eg.E3370).

Product Code: LIMS code for analysis request.

Sample Type/Matrix: The various sample types that can be routed to the method

Method Introduced: Date that the method was implemented at the laboratory.

Reporting Units: Unit of measurement in which the results are reported.

Supervisor/Scientist: Name of supervisor/scientist responsible for the method.

SAMPLING:
The type of container and preservative (if applicable) that is used and minimum volume of sample that is usually required. Any sample preparation that is normally performed in the field, is also indicated[1].

SAMPLE PREPARATION:
Sample preparation techniques which are usually performed at the laboratory before analysis.

ANALYTICAL PROCEDURE:
Brief summary of the analytical method used to determine the parameter.

INSTRUMENTATION:
Type of instrumentation used to perform the test. Examples: Automated continuous flow systems consist of a sampler, peristaltic pump, manifold for reagent addition, detection system and readout system. Personal computers are used to control the operation of analytical equipment and/or data acquisition.

REPORTING:
W and T are method attributes that can be used to qualify low level data[4]. A value reported with the qualifier <=W indicates no measurable response was observed under the conditions of the test and the value accompanying the remark is the lowest reportable value of the method. A value reported as <T is interpreted as a measurable trace amount of the constituent, but under the conditions of the test are not satisfactorily verifiable. Interpret data with caution. When dilutions are required, WE and TE are used as data qualifiers to indicate that the smallest measurable amount (W) and the limit of reliability (T) respectively have increased proportionately to the level of dilution.
To provide a consistent LSB approach to data reporting, GCMS calculates **W**, the minimum reporting value, from the standard deviation of duplicates (S_2), near zero, by rounding down to the nearest 1,2 or 5 digit (4). **T** is the method detection limit and is five times W. The latest calculations, valid at the date of publication for W and T values of all active methods, are contained in this report (APPENDIX A).

Maximum significant figures are the maximum number of significant figures that are reported in LIMS.

Full Scale is the maximum concentration of the calibration range of the analytical system. Samples that exceed the full scale must be diluted accordingly.

CALIBRATION:
The number of standards used to calibrate the analytical system plus blanks if applicable.

CONTROLS:
The calibration, drift, recovery, certified reference material and interference controls that are used when applicable to ensure that the system is operating properly.

MODIFICATIONS:
Modifications made to the test in 2006.
NOTES:
Explanatory notes which may aid the data user in interpreting results and information.

1.2 PERFORMANCE DATA SUMMARY

QUALITY CONTROL DATA FROM/TO: (Optional)
The period of time over which data was collected.

ANALYTICAL RANGE AND REPORTING UNIT:
The full scale value for the analytical range is given in concentration units.

CALIBRATION CONTROL:
Calibration control includes a table outlining the number of data collected over the selected time period, expected concentrations of the control standards, the calculated mean concentration of these standards, mean bias (mean concentration minus the expected concentration), and standard deviations of each control standard. The between run standard deviation (S), the within run standard deviation (S_w), the ratio S/S_w, and the control limits for standards sums and differences are provided.

RECOVERIES (Where applicable):
The table outlines the number of data collected over the selected time period, expected concentrations of the recovery standards, the calculated mean concentration of these standards, and standard deviations of each recovery standard.

DUPLICATES:
The table outlines within run duplicate data collected over the selected time period. Data is sorted into a number of concentration spans. The standard deviation for duplicates is provided for each range. The coefficient of variation (%) is determined by dividing the mean standard deviation (S_2) for a particular concentration span by the mean concentration of duplicate results in that span and multiplying by 100.

OTHER CHECKS (Where applicable):
The table outlines the number of data collected over a selected time period, the calculated mean concentration and standard deviation.

1.3 QUALITY CONTROL GRAPHICS

CALIBRATION CONTROL:
Calibration control standards sums and differences are plotted for the period of data collection (referred to on the graphs as "QUALITY CONTROL STANDARD A+B" for example). The vertical scale consists of the warning/control limits expressed on either side of the expected value. These limits were chosen from analytical performance data.

NOTE:

DATE FORMAT:
mm/dd/yy

2.0 ANALYTICAL QUALITY CONTROL PROGRAM

Quality control is a continuous process that involves constant checks of sample processing procedures. This report summarizes the QC data collected during analytical processing to monitor performance of the analytical system.

Calibration Standards are verified for identity, purity and concentration accuracy by comparison against independent sources wherever possible. Usually, a series of calibration standards are analyzed covering the analytical range.

Once a system has been calibrated, quality control begins. Depending on the analytical procedure, quality control may be used to evaluate: calibration, blank, recovery, sensitivity, potential interference, and sample repeatability.

Calibration and Blank

Calibration is controlled by a minimum of two quality control standards and usually a long term blank which are prepared and maintained independently of the calibration standards. The system is not calibrated with the quality control standards. The long term blank is Pure De-ionized Water (Pure-DW) used to prepare the quality control standards and has zero concentration of the target analyte. Control standards are prepared less frequently than calibration standards, thus allowing an independent cross check of the newly prepared calibration standards. When control standards are prepared, they are checked over three consecutive runs and must be within the warning limits (two standard deviations of theoretical value) before routine use.

The standard deviation of the control standards is used to estimate the between-run standard deviation (S) and is compared against the within-run standard deviation (S_w). If the ratio S/S_w exceeds 1.5 then poor control of systematic error can be inferred[3]. Values for S and S_w are calculated as follows:

$$2S^2 = (S_A)^2 + (S_B)^2 \qquad 2S_w^2 = (S_{A-B})^2$$

Where

S_A = standard deviation (s.d.) of control standard A
S_B = s.d. of control standard B
S_{A-B} = s.d. of the difference between control standards A and B

NOTE: If a second range is employed for a test, more control standards are used because, in many systems, the between-run standard deviations are concentration dependent.

Detailed description of the quality control processes are outlined in several LSB documents [3,4,5] and [9].

Control/Warning Limits

The control standards data is assessed and compared against the control/warning limits established from previous data to determine whether the calibration process is in control. The limits are set up initially based on method performance[4], and are reviewed when method and/or performance data reviews are conducted to determine if modifications are required based on historical data calculations. Control limits are calculated for the sums and differences of control standards (A, B, C, D) by the equations:

$(A+B) \pm 4(S_{A-B})$ for the sum of A+B
$(B+C) \pm 4(S_{B-C})$ for the sum of B+C
$(C+D) \pm 4(S_{C-D})$ for the sum of C+D

$(A-B) \pm 3(S_{A-B})$ for the difference of A-B
$(B-C) \pm 3(S_{B-C})$ for the difference of B-C
$(C-D) \pm 3(S_{C-D})$ for the difference of C-D

Note: Warning Limits are calculated by the same formulae above (using ±2 instead of 4 and 3 respectively).

If a control limit is exceeded, the analysis is stopped, and corrective action is taken.

Recovery

Some methods require sample pre-treatment, such as digestion or extraction. A recovery check, suitable to that method, is required to estimate the efficiency of the pre-treatment. Recovery standards are usually prepared at 0%, 20% and 80% of full scale. The solutions are analysed in the same manner as routine samples. Although these solutions are not used to calibrate the instrument corrections for the blank are calculated and applied if necessary. For an analytical run to be accepted, the recoveries should be within ±3x standard deviation of their expected values. (See Section 1.1 "Reporting" for T determination). The average blank should be within three standard deviations of its historical mean. If a second range is employed for a test, at least one additional recovery standard is used.

Sensitivity and Baseline

Any change in the sensitivity of the instrumentation is monitored periodically during the run, as defined by the method, by analysing a standard that is usually 80% of full scale, and comparing the reading to the original calibration standards. Baseline drift is usually recorded by periodic analysis, as defined by the method, of Pure-DW which does not contain any of the analyte, but may be treated to correspond to sample pre-treatment.

Interference

The interference check is run on any test where a substance may be present in concentrations that affect the results. The check is carried out near the threshold concentration of the interfering substance, beyond which the methodological safeguards used to minimize the interference are no longer effective. The check indicates that the interference has no effect up to the specified concentrations.

Sample Repeatability

Generally, one sample out of twenty is analysed in duplicate up to a maximum of three duplicates per analytical run. The samples are selected for non-adjacent, within-run duplicate analyses. By analysing samples in duplicate, the ability of the analyst to obtain repeatable analytical results, within an analytical run, can be determined. For results to be acceptable, at least two of the three duplicate pairs must conform to limits that are set based on historical performance.

Duplicate data are accumulated and usually sorted into 3 ranges of 0-10 or 0-20, 21-50, 51-100 percent of full scale. More ranges may be added where the analytical scale spans are greater than 2 log scales. When less than 3 data pairs are collected, the remark N.A. (not available) is reported. A standard deviation is calculated for each concentration range. The limits are established at 3*S.D. The algorithm differs from the conventional standard deviation as follows

Conventional Std. Dev. (1)*

$$S_1 = \sqrt{\frac{\sum_{i=1}^{n} (\overline{X} - X_i)^2}{n-1}}$$

Within-run Std. Dev of Duplicates (2)*

$$S_2 = \sqrt{\frac{\sum_{i=1}^{n} (X_1 - X_2)_i^2}{2n}}$$

* Standard deviations used for the data summaries.

Where S_1 = sample standard deviation
S_2 = duplicate difference standard deviation
N = number of data
$\overline{x}$ = mean of data
x_i = i^{th} result
$(x_1 - x_2)_i$ = difference of the i^{th} duplicate
n' = number of duplicate pairs

The standard deviation (S_2) of the duplicate difference is also expressed as the coefficient of variation (CV).

$$CV = \frac{S^2}{x} \quad X100$$

2.1 PERFORMANCE SUMMARIES

ALKALINITY, TOTAL FIXED ENDPOINT

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No ___	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	09/07/80
Method Reference No.	E3218	Reporting Unit	mg/L as $CaCO_3$
LIMS Product Code	PHALCO3218	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples (30.0 mL) are titrated with 0.02 N sulphuric acid to pH endpoint of 4.5. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH reading following each aliquot of titrant.
pH, and conductivity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with computer control and data processing software.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.5	Current T value: 2.5	Full Scale: 1000 mg/L

STANDARDIZATION:

Titrant, 0.02N sulphuric acid, is standardized.

CONTROLS:

Standardization and checks	BL plus 4 standards, e.g. QCA
Drift	In run standards throughout the run (tap water diluted to 50% V/V)

NOTES:

May '97 the W value was changed from 0.2 to 0.5 after a review of 2 years low level duplicate data '94-95.

ALKALINITY, TOTAL FIXED ENDPOINT (E3128)

QUALITY CONTROL DATA FROM 01/06/07 TO 12/21/06

Analytical Range : to 1000 mg/L as CaCO3

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	95	250	250.77	0.774	1.623
B	95	100	100.44	0.442	0.970
C	95	25	25.21	0.212	0.371
D	95	2.5	2.49	-0.008	0.114
A + B	95	350	351.22	1.217	2.298
A - B	95	150	150.33	0.332	1.369
B + C	95	125	125.65	0.654	1.218
B - C	95	75	75.23	0.230	0.840
C + D	95	27.5	27.70	0.204	0.417
C - D	95	22.5	22.72	0.221	0.398

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	1.34
	Within Runs	0.97
	Between/Within	1.4
s.d.(BC)	Between Runs	0.74
	Within Runs	0.59
	Between/Within	1.2
s.d(CD)	Between Runs	0.29
	Within Runs	0.28
	Between/Within	1.0

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	346.5	353.5	343	357
A - B	146.5	153.5	144.75	155.25
B + C	123.25	126.75	121.5	128.5
B - C	73.25	76.75	72.4	77.6
C + D	26.66	28.34	25.82	29.18
C - D	21.66	23.34	21.24	23.76

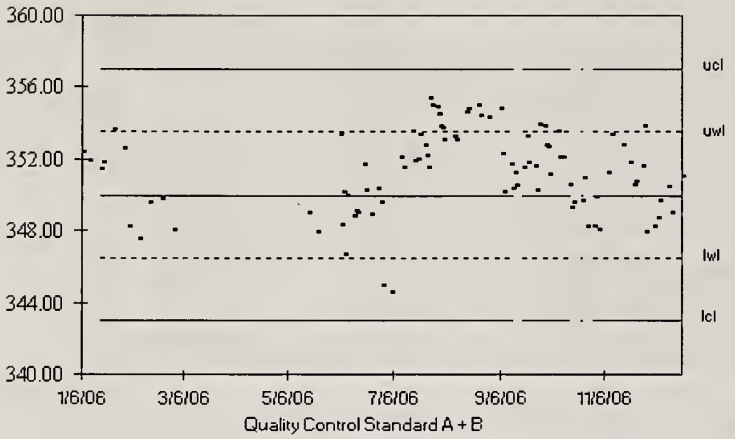
Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
43	0 - 50	0.3621	1.6
61	51 - 100	0.6506	0.8
144	101 – 300	2.2439	1.2
19	301 – 1000	6.8874	1.7
267	overall	2.4997	1.6

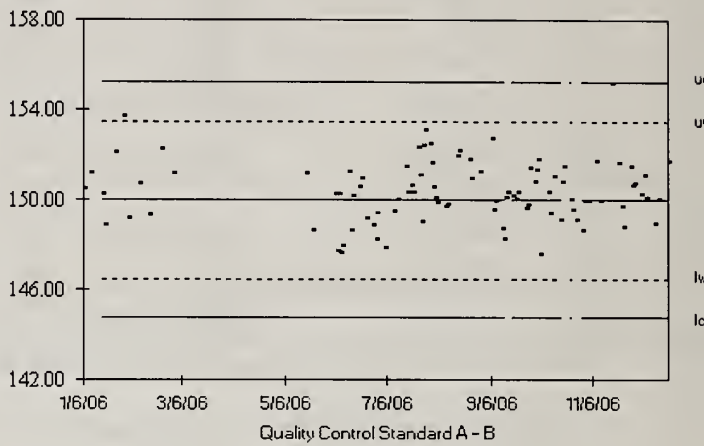
ALKALINITY, TOTAL FIXED ENDPOINT (E 3218)

QUALITY CONTROL DATA FROM 01/06/06 TO 12/21/06

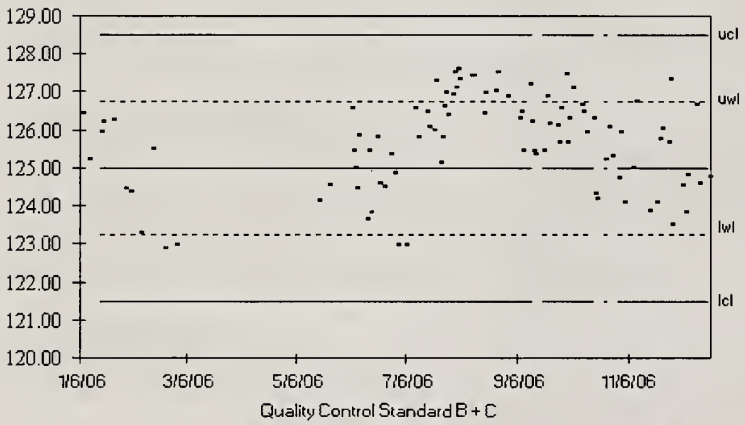
Analytical Range: to 1000 mg/L as $CaCO_3$



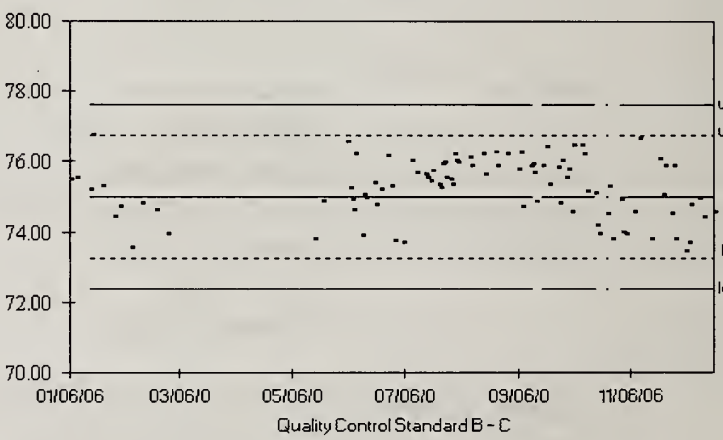
Quality Control Standard A + B



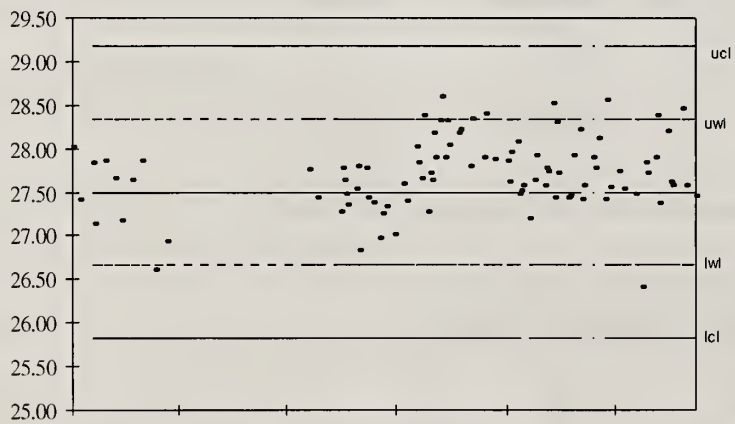
Quality Control Standard A - B



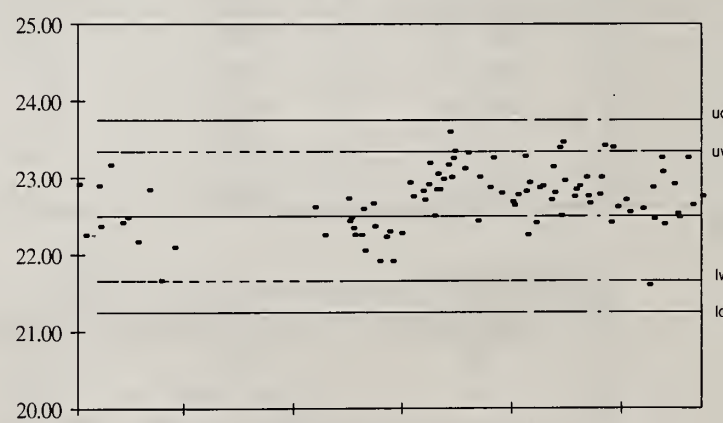
Quality Control Standard B + C



Quality Control Standard B - C



Quality Control Standard C + D



Quality Control Standard C - D

BROMATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status :	Licensed (Drinking Water) ☑
Yes ☑ No ____	Reportable Limit (OSDWA): 0.01 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	10/09/2002
Method Reference No.	E3434	Reporting Unit	µg/L as BrO_3^-
LIMS Product Code	BROM3434	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required	50 mL
Container	PET bottle
Preservative(s)	Ethylenediamine

ANALYTICAL PROCEDURE:

Via ion chromatography (IC), bromide and bromate are separated from other anions using columns packed with ion exchange resin and an eluent solution of sodium carbonate. The ions of interest are detected by an conductivity detector and an Ultraviolet/visible (UV/VIS) absorbance detector. The concentration of Bromide and Bromate in µg/L as Br^- & BrO_3^- are determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic automated modular continuous flow ion chromatographic system with gradient flow control module, a postcolumn delivery system (pneumatically controlled), a heated postcolumn reaction coil, a conductivity detector and an Ultraviolet/visible (UV/VIS) absorbance detector.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full scale: 30.00 µg/L

CALIBRATION:

BL plus 6 standards

BROMATE cont'd

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA and one certified standard
Drift	In run standards every 10 samples
Recovery	BL and samples spiked with 5 µg/L Bromate solution

NOTES:

Concentration range was extended from 15 mg/L to 30 mg/L in January 2006.

BROMATE (E3434)

QUALITY CONTROL DATA FROM 01/24/2006 TO 12/23/2006

Analytical Range: to 30 µg/L as BrO_3^-

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	14	24	23.9054	-0.0946	0.3114
B	14	15	14.8208	-0.1792	0.4105
C	14	6	5.6202	-0.3798	0.2645
A + B	14	39	38.6262	-0.3738	0.7326
A - B	14	9	8.9845	-0.0155	0.2748
B + C	14	21	20.4410	-0.5590	0.6528
B - C	14	9	9.2007	0.2007	0.2254

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.3644
	Within Runs	0.1943
	Between/Within	1.87
s.d.(BC)	Between Runs	0.3453
	Within Runs	0.1594
	Between/Within	2.17

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	38.4503	39.5497	37.9007	40.0993
A - B	8.4503	9.5497	8.1755	9.8245
B + C	20.5491	21.4509	20.0982	21.9018
B - C	8.5491	9.4509	8.3237	9.6763

Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
14	0.0 - 10.0	0.0336	3.2135
2	10.1 - 20.0	N/A	N/A
1	20.1 - 50.0	N/A	N/A
1	50.1 - 100.0	N/A	N/A
18	Total	0.2045	2.5868

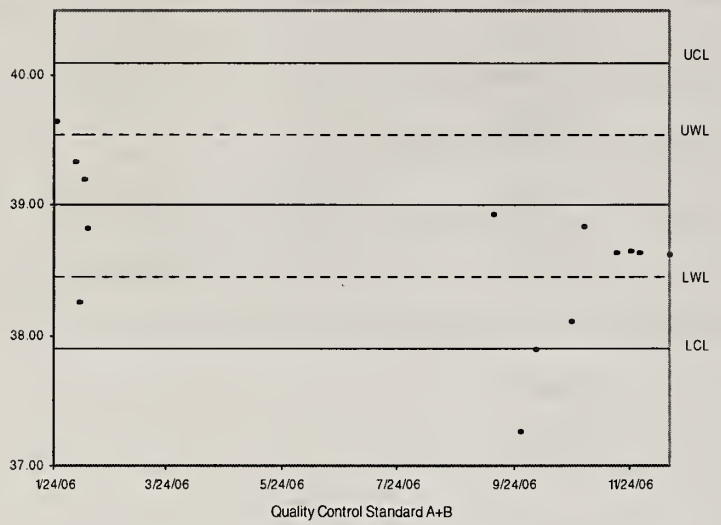
Other Checks:

	Number	Expected	Mean	Std. Dev.
Spike Recovery (5 µg/L)	11	5	4.9381	0.4735
LTB	5	0	0.2012	0.6853

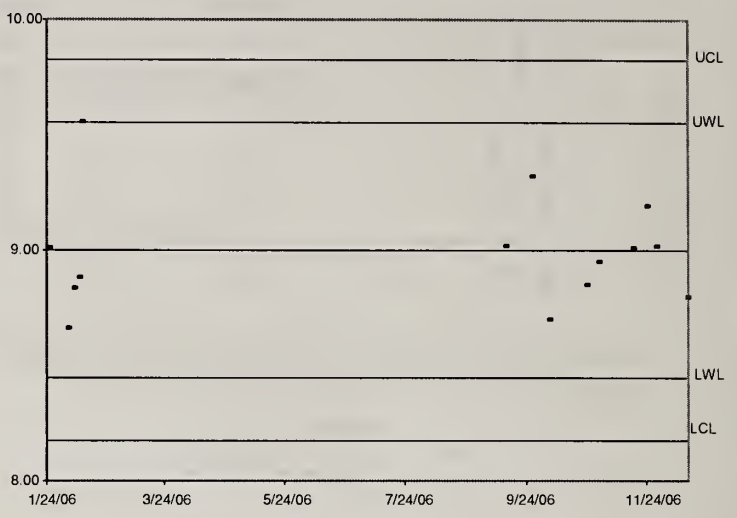
BROMATE (E3434)

QUALITY CONTROL DATA FROM 01/24/2006 TO 12/14/2006

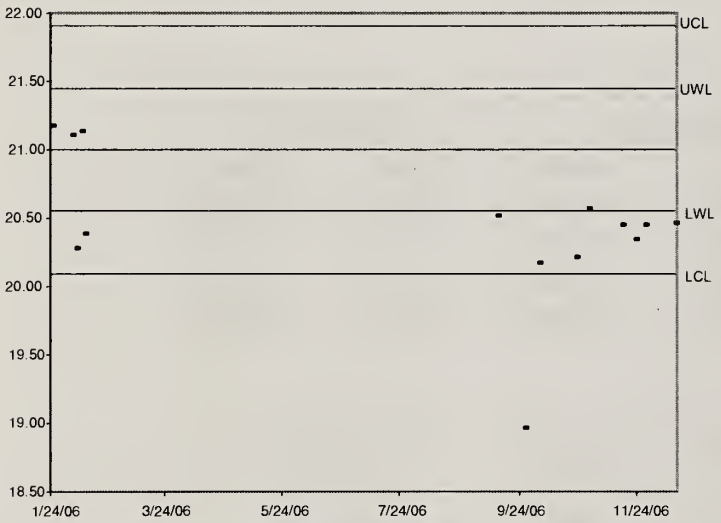
Analytical Range: to 30.0 µg/L as BO_3



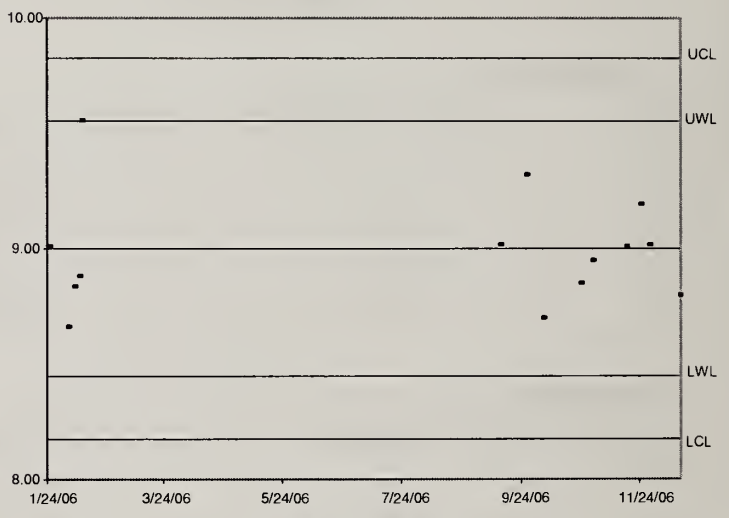
Quality Control Standard A+B



Quality Control Standard A-B



Quality Control Standard B+C



Quality Control Standard A-B

BROMIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No ____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	10/09/2002
Method Reference No.	E3434	Reporting Unit	µg/L as Br^-
LIMS Product Code	BROM3434	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required	50 mL
Container	PET bottle
Preservative(s)	Ethylenediamine

ANALYTICAL PROCEDURE:

Via ion chromatography (IC), bromide and bromate are separated from other anions using columns packed with ion exchange resin and an eluent solution of sodium carbonate. The ions of interest are detected by a conductivity detector and an Ultraviolet/visible (UV/VIS) absorbance detector. The concentration of Bromide and Bromate in µg/L as Br^- & BrO_3^- is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic automated modular continuous flow ion chromatographic system with gradient flow control module and a conductivity detector chromeleon software version 6.60.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 300.00 µg/L

CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA and one certified standard
Drift	In run standards every 10 samples

NOTES:

The concentration range was extended from 30 µg/L to 300 µg/L in January 2006.

BROMIDE (E3434)

QUALITY CONTROL DATA FROM 01/24/2006 TO 12/14/2006

Analytical Range: to 300.0 µg/L as Br^-

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	18	240	240.318	0.318	2.5249
B	18	150	149.5754	-0.4246	1.138
C	18	60	58.8712	-1.1288	0.9042
A + B	18	390	389.8933	-0.1067	3.7897
A - B	18	90	90.7426	0.7426	1.7785
B + C	18	210	208.4466	-1.5534	1.7597
B - C	18	90	90.7042	0.7042	1.0623

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	1.96
	Within Runs	1.26
	Between/Within	1.56
s.d.(BC)	Between Runs	0.75
	Within Runs	1.03
	Between/Within	1.37

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	386.443	397.1139	382.8861	393.5570
A - B	86.4430	95.3354	84.6646	93.5570
B + C	207.8753	214.2493	205.7507	242.1247
B - C	87.87533	93.187	86.846	92.1247

Duplicates:

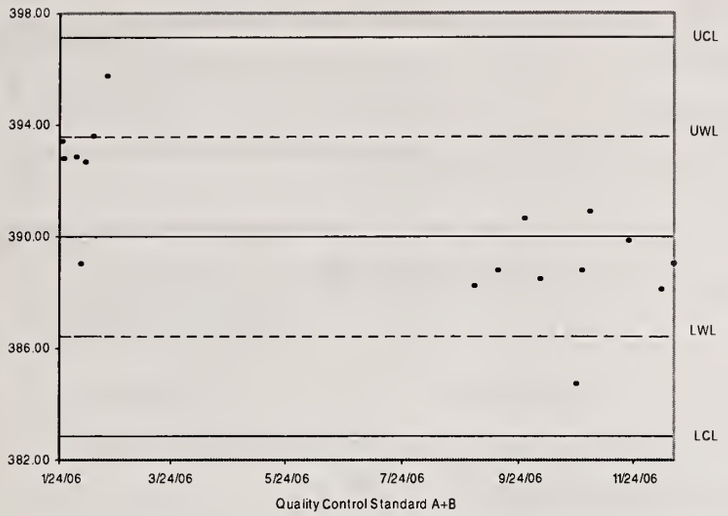
Number	Concentration	Std. Dev.	% Coeff of Var
14	0.0 - 10.0	1.716	27.4
5	10.1 - 20.0	3.747	26.6
3	20.1 - 50.0	0.628	1.8
0	50.1 - 100.0	N/A	N/A
23	Total	2.213	14.3

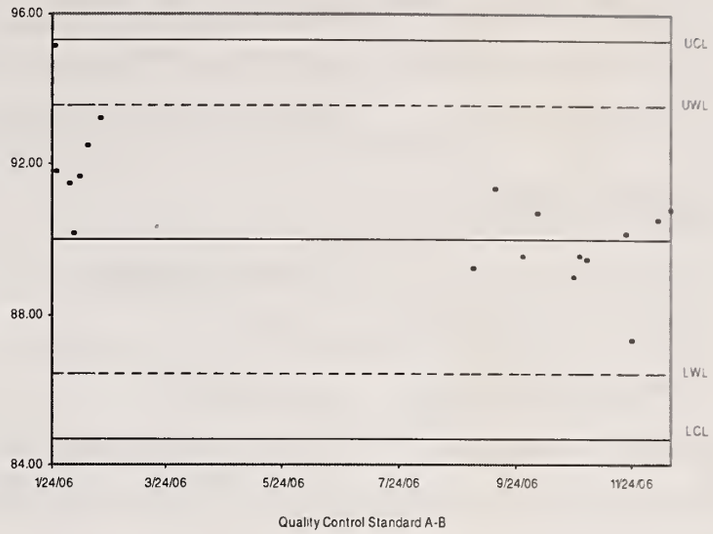
Recoveries	Number	Expected	Mean	Std. Dev (1)
Long Term Blank	11	0.0603	0.7439	1.5045

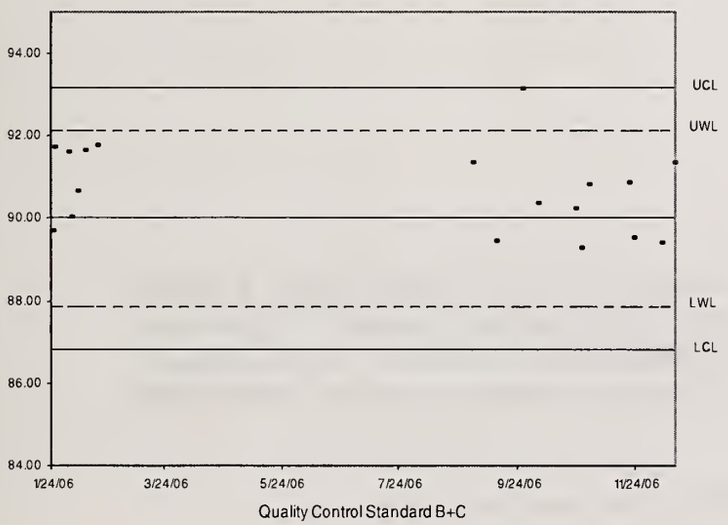
BROMIDE (E3434)

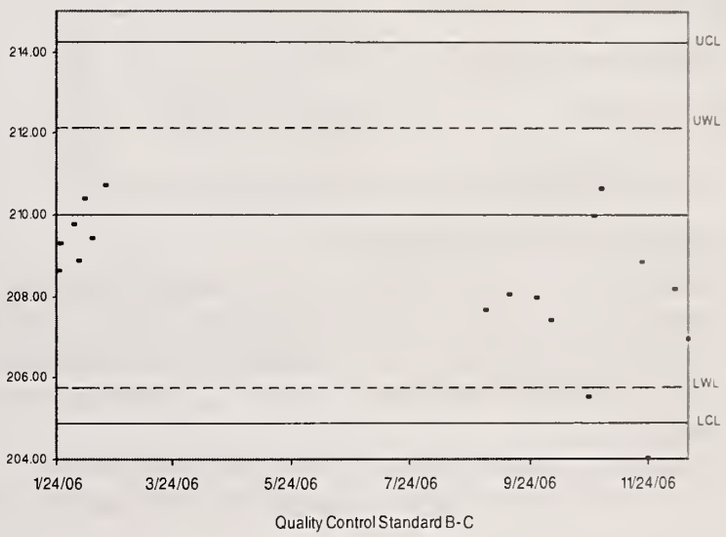
QUALITY CONTROL DATA FROM 01/24/2006 TO 12/14/2006

Analytical Range: to 300 µg/L as Br









CARBON, DISSOLVED INORGANIC

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes:_ ☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3370	Reporting Unit	mg/L as C
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Dissolved inorganic carbon, which is determined colourimetrically on the supernatant of a settled sample, is converted to carbon dioxide gas by acidification. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved inorganic carbon content of the sample.

Approximate absorbance: 0.3 at the full scale level.

Dissolved organic carbon, and reactive silicates are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: air (CO_2-free) supply, dialysis unit. Colourimetric measurement is through a 5.0 cm. light path at 550 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 80 mg/L

CALIBRATION:

BL plus 7 standards

CARBON, DISSOLVED INORGANIC cont'd

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL , standard and BL every 10 samples

NOTES:

December 1998: The HP data capture/processing system was replaced by "Labtronics" Data Acquisition software.

CARBON; DISSORLVED INORGANIC (E3370)

QUALITY CONTROL DATA FROM 01/01/2006 TO 12/31/2006

Analytical Range: to 80 mg/L as C

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	46	64	64.154	0.154	0.519
B	46	16	16.102	0.102	0.329
C	46	4	4.118	0.118	0.197
A + B		80	80.256	0.256	0.642
A – B		48	48.052	0.052	0.585
B + C		20	20.220	0.220	0.431
B – C		12	11.984	-0.016	0.329

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.4344
	Within Runs	0.4137
	Between/Within	1.0500
s.d.(BC)	Between Runs	0.2710
	Within Runs	0.2326
	Between/Within	1.1651

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	78.93	81.07	77.86	82.14
A – B	46.93	49.07	46.40	49.60
B + C	19.42	20.58	18.80	21.10
B – C	11.42	12.58	11.12	12.88

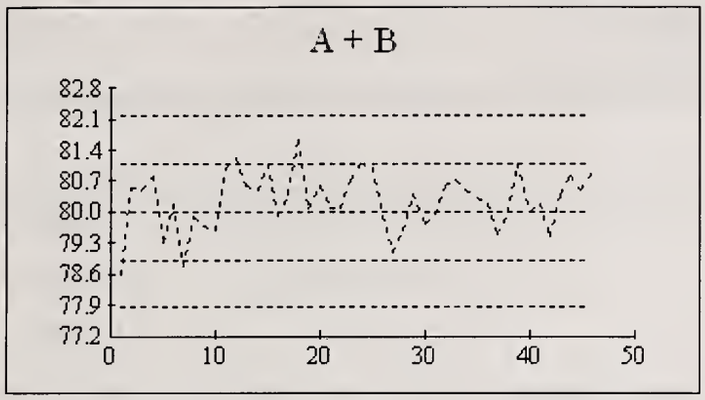
Duplicates:

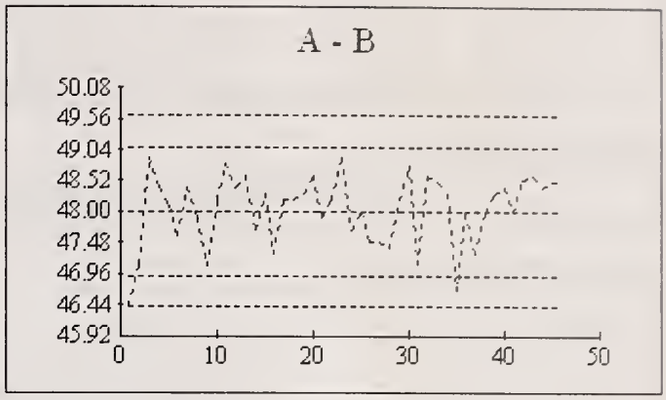
Number	Concentration	Std. Dev.	% Coeff of Var
9	0 – 10%	0.106	4.698
14	10 – 20%	0.181	1.717
77	20 – 50%	0.270	1.136
24	50 – 100%	0.387	0.710
124	Total	0.281	1.054

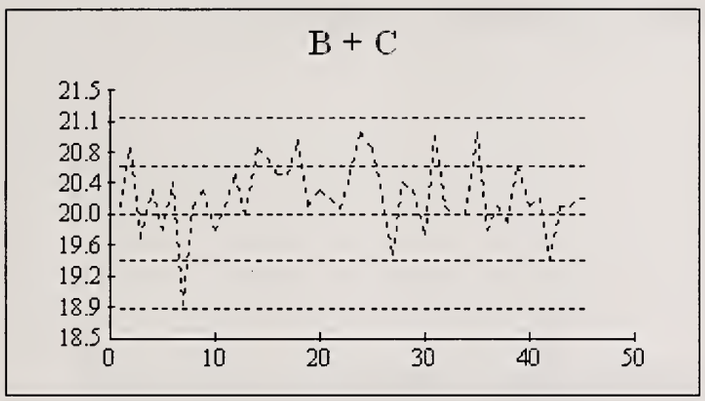
Other Checks	Number	Mean	Std. Dev.
LTB	46	0.002	0.301

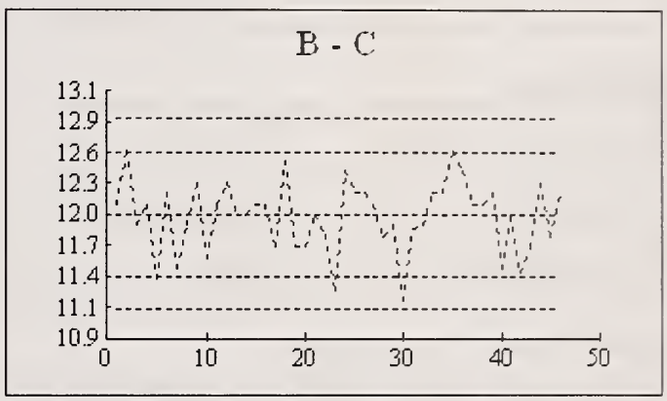
Carbon; dissolved inorganic (E3370)

QC Data; 1/1/2006 to 12/31/2006









CARBON, DISSOLVED ORGANIC

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _ ☑ _ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3370	Reporting Unit	mg/L as C
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Using an automated system, the supernatant from a settled sample is acidified and flushed with nitrogen gas to remove inorganic carbon. Organic carbon is then oxidized to carbon dioxide gas by exposure to ultra-violet light (UV) in acid-persulphate media. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved organic carbon content of the sample. Approximate absorbance: 0.3 at the full scale level.
Dissolved inorganic carbon, and reactive silicates are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: nitrogen and air (CO_2–free) supplies with flow controls, dialysis unit, UV digestor. Colourimetric measurement is through a 5.0 cm. light path at 550 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.1	Current T value: 0.5	Full Scale: 20mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL , standard and BL every 10 samples

NOTES:

December 1998: The HP data capture/processing system was replaced by "Labtronics" Data Acquisition software.

CARBON; DISSOLVED ORGANICS (E3370)

QUALITY CONTROL DATA from 01/01/2006 to 12/31/2006

Analytical Range; to 20 mg/L as C

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	46	16	16.113	0.113	0.185
B	46	4	4.023	0.023	0.115
C	46	1	1.021	0.021	0.083
A + B		20	20.136	0.136	0.227
A - B		12	12.091	0.091	0.209
B + C		5	5.043	0.043	0.168
B - C		3	3.002	0.002	0.109

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.1543
	Within Runs	0.1478
	Between/Within	1.04
s.d.(BC)	Between Runs	0.1002
	Within Runs	0.0771
	Between/Within	1.30

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	19.72	20.28	19.44	20.56
A - B	11.72	12.28	11.58	12.42
B + C	4.78	5.22	4.56	5.44
B - C	2.78	3.22	2.67	3.33

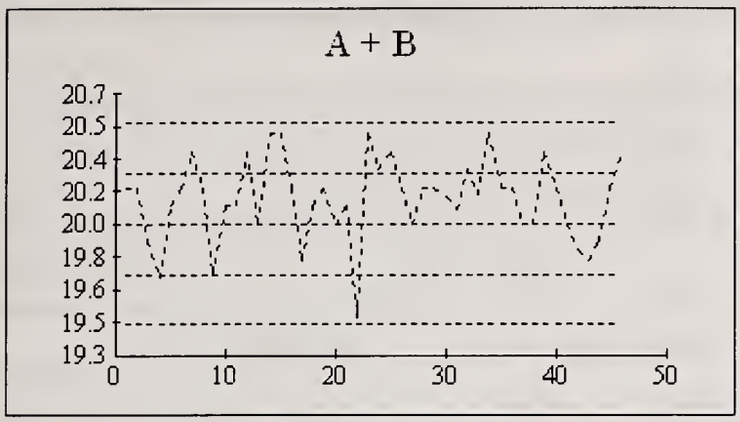
Duplicates:

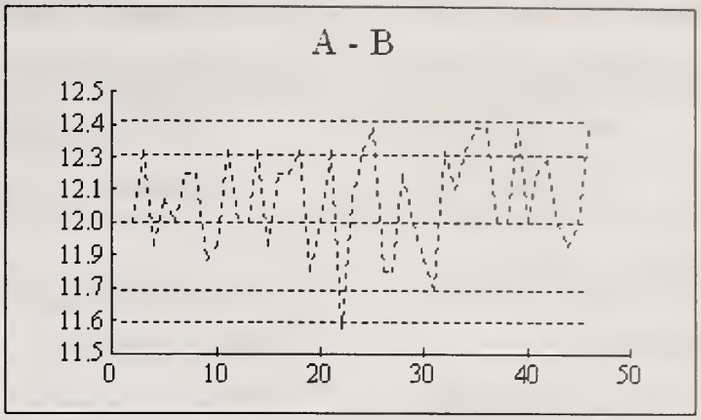
Number	Concentration	Std. Dev.	% Coeff of Var
43	0 - 10%	0.095	6.892
34	10 - 20%	0.132	4.642
41	20 - 50%	0.142	2.661
4	50 - 100%	0.112	0.776
122	Total	0.123	3.470

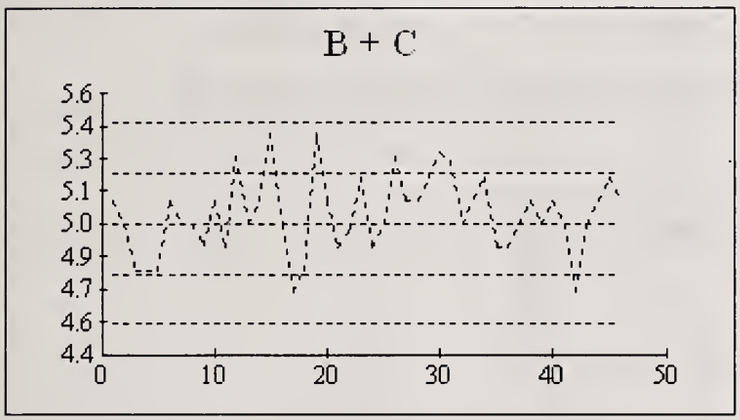
Other Checks	Number	Mean	Std. Dev.
Long Term Blank	46	-0.02	0.113

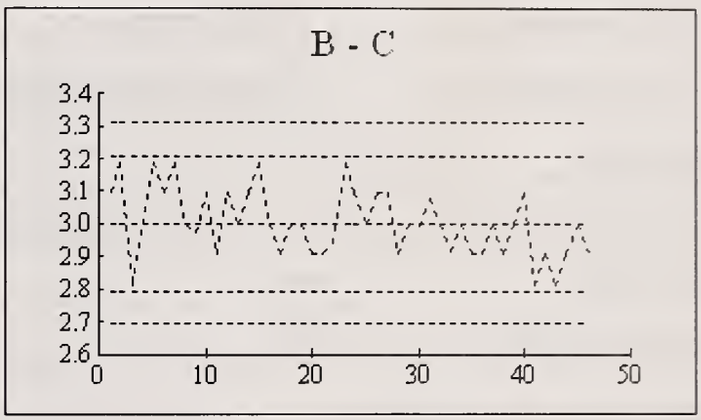
Carbon; dissolved organic (E3370)

QC Data; 1/1/2006 to 12/31/2006









CHLORIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Reporting Unit	$\mu g/m^3$ as Cl
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	¾" or 1.9cm strip from 8"x10" filter
Container	N/A
Preservative(s)	N/A

SAMPLING PREPARATION:

A ¾" filter strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of chloride (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation. The result is reported as $\mu g/m^3$ as Cl.
Nitrate and sulphate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.1$\mu g/m^3$	Current T value: 0.5 $\mu g/m^3$	Full Scale: 28.6 $\mu g/m^3$

CALIBRATION:

9 standards

CHLORIDE cont'd

CONTROLS:

Calibration	MB, CS1, and CS2, QCA and QCB
Drift	2 standards every 20 samples
Recovery	CS4 & CS5

NOTES:

To convert unit from mg/L to $\mu g/m^3$, the final concentration of Cl in $\mu g/m^3$ is calculated by the following formula:

$$\text{Result (mg/L) X 50mL X (63/6.75) / air volume} = \mu g/m^3$$

Where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

Calibration control standards and in house control standards (CS4 & CS5) are reported in mg/L.

CHLORIDE (E3004)

QUALITY CONTROL DATA FROM 01/05/2006 TO 09/27/2006

Analytical Range: to 28.6 µg/m³ (*100.0 mg/L) as Cl

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
***A**	8	80	79.6946	-0.3054	0.2933
***B**	8	20	19.9751	-0.0249	0.0956
***A + B**	8	100	99.6698	-0.4234	0.2839
***A – B**	8	60	59.7195	-0.2805	0.3312

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.2342
	Within Runs	0.2181
	Between/Within	0.93

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
*A + B	98.81	101.19	97.63	102.37
*A – B	58.81	61.19	58.22	61.78

In House Control standard for 01/05/06 to 09/24/2006

	Number	Expected	Mean	Mean Bias	Std. Dev. (1)
*CS4	8	3.09	2.9161	-0.1739	0.1850
*CS5	8	19.135	19.2243	0.0893	0.6238

The calibration is accepted if the calibration control values obtained lie within the range:

2.59	-	3.59	for CS4
17.53	-	20.75	for CS5

Duplicates:

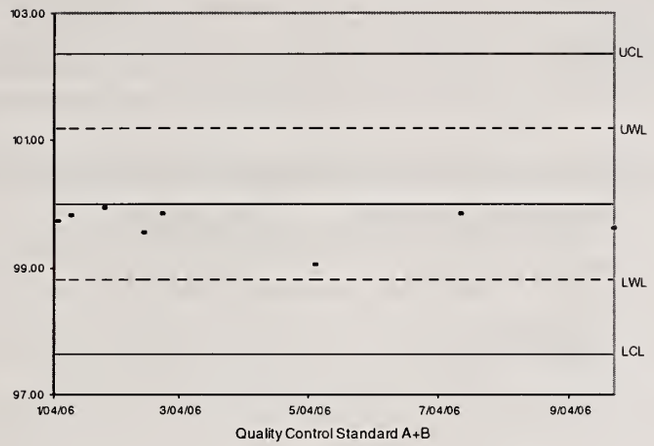
Number	Concentration	Std. Dev.	% Coeff of Var
18	0.0 – 2.86	0.0441	13.2
1	2.89 – 7.15	N/A	N/A
0	7.18 – 14.31	N/A	N/A
0	14.33 – 28.61	N/A	N/A
19	Total	0.0726	14.6

* Results are reported in mg/L

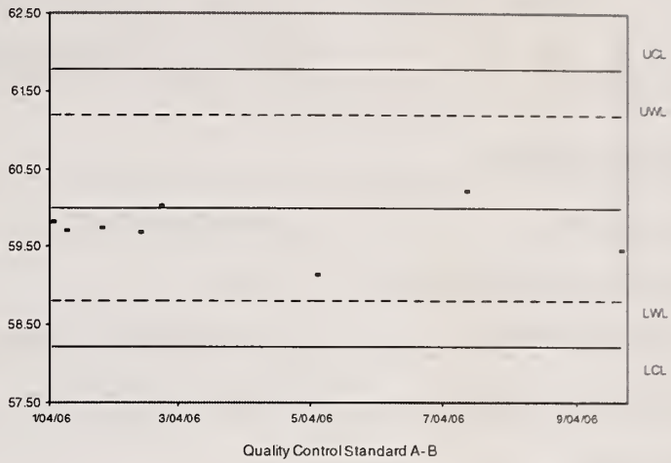
CHLORIDE (E3004)

QUALITY CONTROL DATA FROM 01/05/2006 TO 09/27/2006

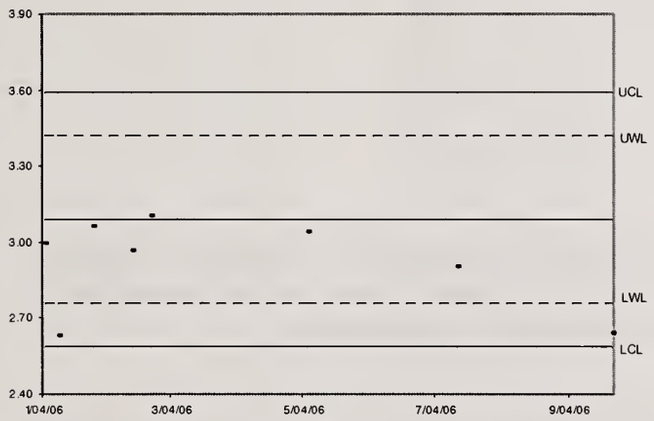
Analytical Range: to 100.0 mg/L as Cl



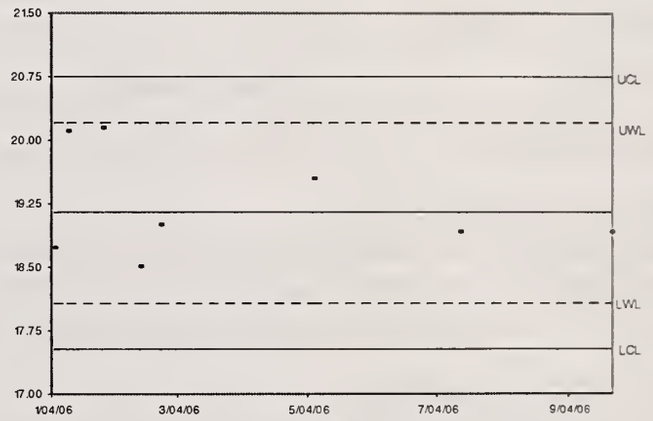
Quality Control Standard A+B



Quality Control Standard A-B



CS4



CS5

CHLORIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes _ ☑ _ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/86
Method Reference No.	E3013	Reporting Unit	µg/g as Cl
LIMS Product Code	ANION3013, CL3013	Supervisor	P. Wilson
Sample Type/Matrix	Soil and Sediment		

SAMPLING:

Quantity Required	20 g
Container	glass or plastic
Preservative(s)	N/A

SAMPLING PREPARATION:

A 3.0g sample of air dried, sieved soil or air dried sieved and ground sediment is placed in a 50 mL centrifuge tube and shaken with 30 mL Pure-DW for 1 hour on a shaker. Samples are centrifuged, membrane filtered and analyzed for chloride and sulphate by ion chromatography.

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of chloride (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The result is reported as µg/g as Cl.
Sulphate is determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.5 µg/g	Current T value: 2.5 µg/g	Full Scale: 1000 µg/g

CALIBRATION:

9 standards

CHLORIDE cont'd

CONTROLS:

Calibration	MB, CS1, CS2, QCA and QCB
Recovery	R21, SO201, SO202, R23, R16
Drift	2 standards every 20 samples

NOTES:

R21, SO201 and SO202 were introduced October, 2003.

Calibration control standards are reported in mg/L.

CHLORIDE (E3013)

QUALITY CONTROL DATA FROM 01/11/2006 TO 10/04/2006

Analytical Range: to 1000 µg/g (100mg/L) as Cl

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
***A**	4	80	79.58	-0.42	0.3615
***B**	4	20	19.97	-0.03	0.0742
***A + B**	4	100	99.55	-0.45	0.4153
***A - B**	4	60	59.62	-0.38	0.2737

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.28
	Within Runs	0.04
	Between/Within	6.97

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
*A + B	98.21	101.79	96.42	103.58
*A - B	58.21	61.79	57.32	62.68

Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
7	0.0 - 200	1.3175	1.67
1	201 - 500	N/A	N/A
N/A	501 - 1000	N/A	N/A
8	Total	2.149	2.1

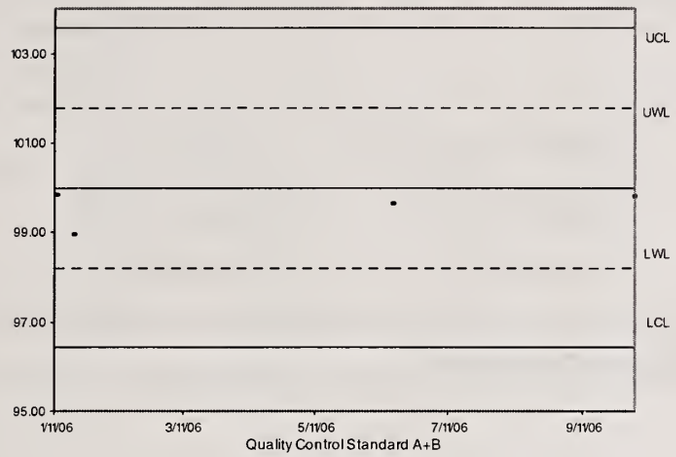
Other Checks	Number	Expected	Mean	Std. Dev. (1)
SO201	4	33.05	29.64	0.5398
SO202	4	3.3	3.70	0.7791
R16	4	34.45	34.52	1.6800
R21	4	16.9	14.99	0.9200

The calibration is accepted if the calibration control values obtained lie within the range:

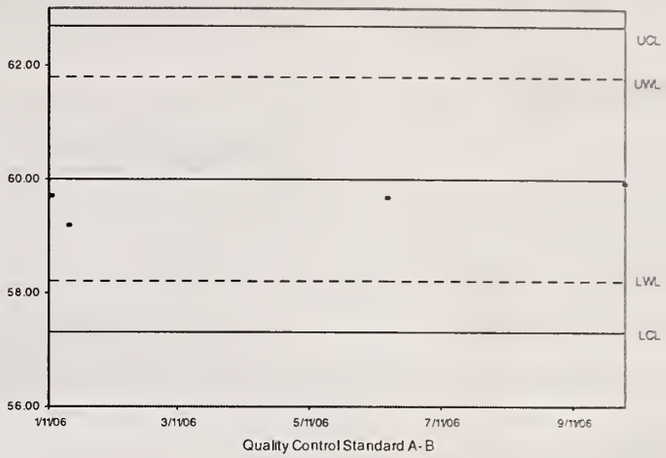
12.3		56.3	for R16
9.3	-	24.5	for R21
18.2	-	47.9	for SOS201
1.8	-	4.8	for SOS202

* Results are reported in mg/L

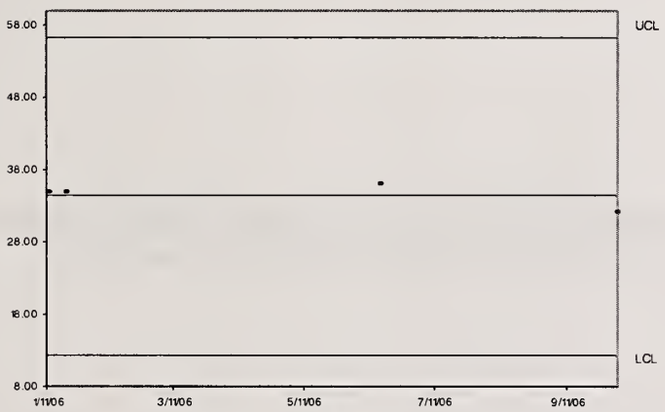
CHLORIDE (E3013)
QUALITY CONTROL FROM 01/11/2006 to 10/04/2006
Analytical Range: to 100 mg/L as Cl



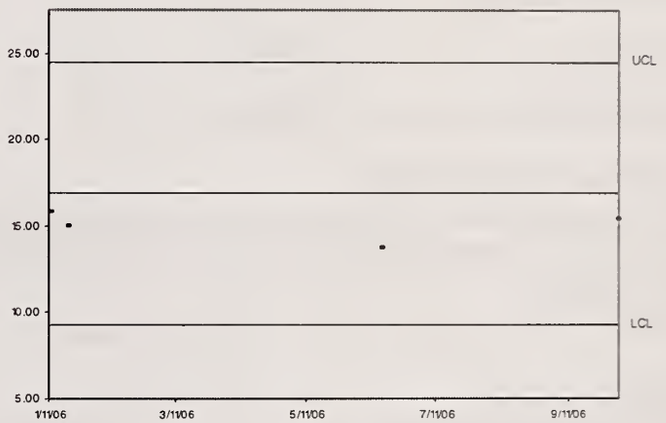
Quality Control Standard A+B



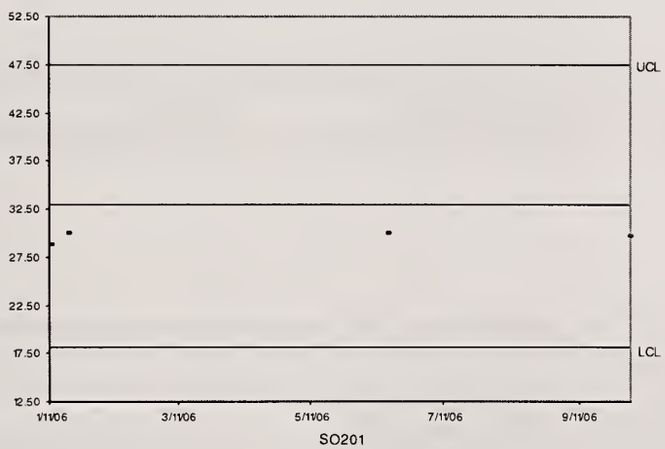
Quality Control Standard A-B



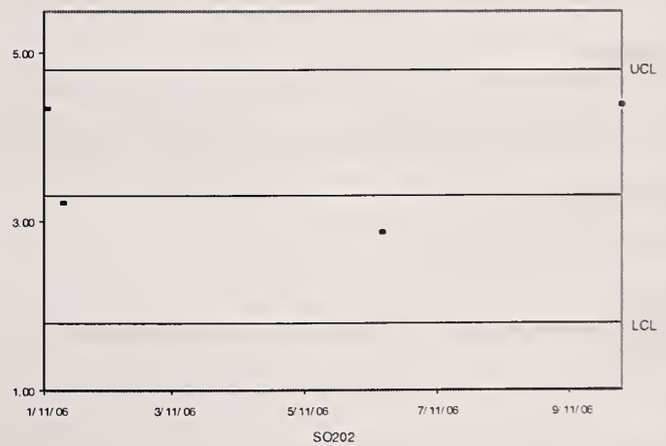
R16



R21



SO201



SO202

CHLORIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _ ☑ _ No ____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/05/75
Method Reference No.	E3016	Reporting Unit	mg/L as Cl
LIMS Product Code	CL3016	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water, Ground Water, Leachate, Surface Water		

SAMPLING:

Quantity Required:	10 mL
Container:	Plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Chloride ions are combined with mercuric thiocyanate releasing thiocyanate quantitatively. Thiocyanate then reacts with ferric ions to produce ferric thiocyanate (red), and the absorbance of the latter is measured colourimetrically.

Approximate absorbance: 0.5 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 1.5 cm light path at 480 nm.

Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 100 µg/L

CALIBRATION:

BL plus 12 standards

CONTROLS:

Calibration:	LTBL plus 3 standards, e.g. QCA
Drift:	BL and standard after every 12 samples

NOTES:

April 1998: The HP data capture/processing system was replaced by "Labtronics" Data Acquisition software. Two additional Calibration standards were added at the low end of the curve.

CHLORIDE (E3016)

QUALITY CONTROL DATA FROM 1/1/2006 TO 12/31/2006

Analytical Range: to 100 mg/L as Cl

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	67	75	75.267	0.267	0.442
B	67	25	25.175	0.175	0.177
C	67	5	4.989	-0.011	0.087
A + B		100	100.442	0.442	0.540
A – B		50	50.092	0.092	0.403
B + C		30	30.163	0.163	0.238
B – C		20	20.186	0.186	0.145

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.3369
	Within Runs	0.2850
	Between/Within	1.1821
s.d.(BC)	Between Runs	0.1394
	Within Runs	0.1025
	Between/Within	1.3600

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	99.30	100.70	98.70	101.13
A – B	49.30	50.70	48.00	51.00
B + C	29.66	30.34	29.30	30.70
B – C	19.66	20.34	19.50	20.50

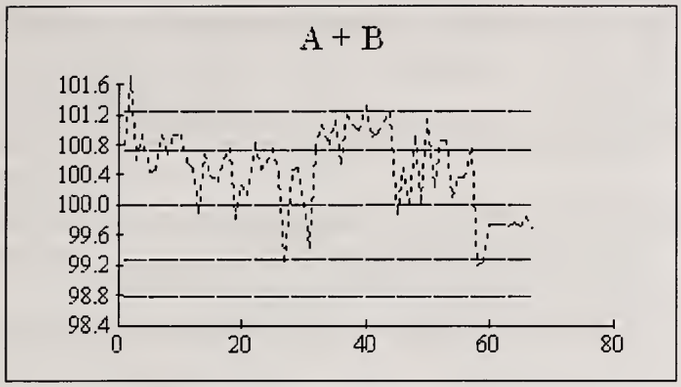
Duplicates:

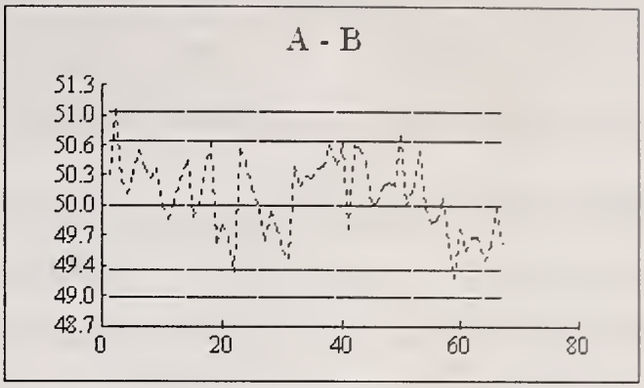
Number	Concentration	Std. Dev.	% Coeff of Var
44	0 – 10%	0.147	3.632
34	10 – 20%	0.121	0.818
72	20 – 50%	0.556	1.79
21	50 – 100%	0.241	0.363
171	Total	0.382	1.515

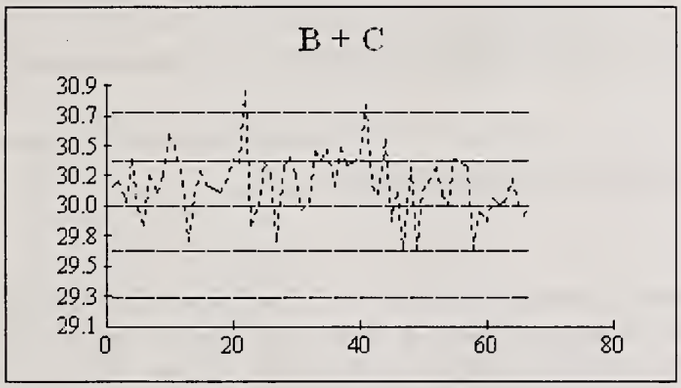
Other Checks	Number	Mean	Std. Dev.
LTB	67	0.029	0.042

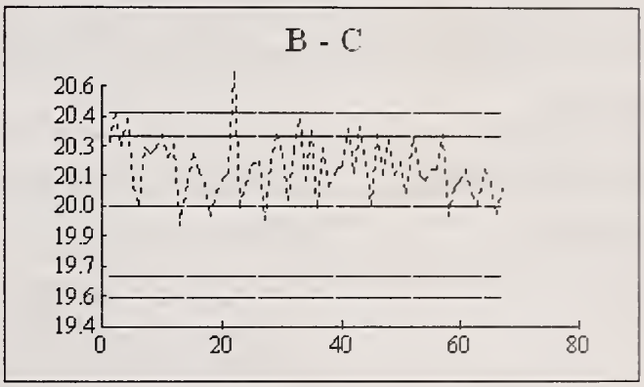
Chloride (E3016)

QC Data; 1/1/2006 to 12/31/2006









CHLOROPHYLL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): No
Yes _ ☑ _ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/75
Method Reference No	E3169	Reporting Unit	µg/L
LIMS Product Code	CHL3169	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	500 mL for clear samples; 250 mL if visibly green
Container	Glass or plastic
Other	In the field a sample is filtered through a nylon filter. The filter is then placed between two membrane filter-support pads, and the package is enclosed in a plastic dish labelled with the sample number and sample volume filtered, the dish is kept in the dark or wrapped in aluminium foil, and shipped immediately, or kept frozen.

ANALYTICAL PROCEDURE:

Chlorophyll 'a', chlorophyll 'b', and corrected chlorophyll 'a' (for pheophytin 'a') are determined by the extraction of the pheopigments into an acetone-water solvent followed by two computer controlled spectrophotometric scans with measurements at 630, 645 and 663 (665 for acidified) nm absorbance measurements. Also, the minimum absorbance between 710 and 750 is measured to allow for a correction due to turbidity. SCOR-UNESCO equations are used for all chlorophyll calculations.

INSTRUMENTATION:

-Automated modular continuous flow scanning spectrophotometer system
-Computer system for control of sampling, timing and data processing (i.e. data capture, calculations and transfer of results to eLAB and LIMS)

CHLOROPHYLL cont'd

REPORTING:

Chlorophyll a; corrected Chlorophyll a; total Chlorophyll b; total	Max. Significant Figures: 3	Current W value: 1.0 Current W value: 0.2 Current W value: 0.1	Current T value: 5.0 Current T value: 1.0 Current T value: 0.5

CONTROLS:

Calibration	LTBL plus 2 "standards", e.g.
Drift	"standard", BL every 20 samples

NOTES:

"Standards" are prepared from chlorophyll "a" and "b", but the materials are neither analytical grade nor are their solutions stable. Thus calibration controls are based on measured averages.

CHLOROPHYLL "a" (E3169)
QUALITY CONTROL DATA FROM 01/05/2006 TO 12/29/2006
Reporting Unit: µg/L

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	35	3.0	3.03	0.03	0.1177
B	35	1.0	1.03	0.03	0.0744
A + B	35	4.0	4.06	0.06	0.1747
A - B	35	2.0	1.99	-0.01	0.0947

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.10
	Within Runs	0.07
	Between/Within	1.47

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	3.81	4.81	3.62	4.38
A - B	1.81	2.19	1.72	2.28

Duplicates:

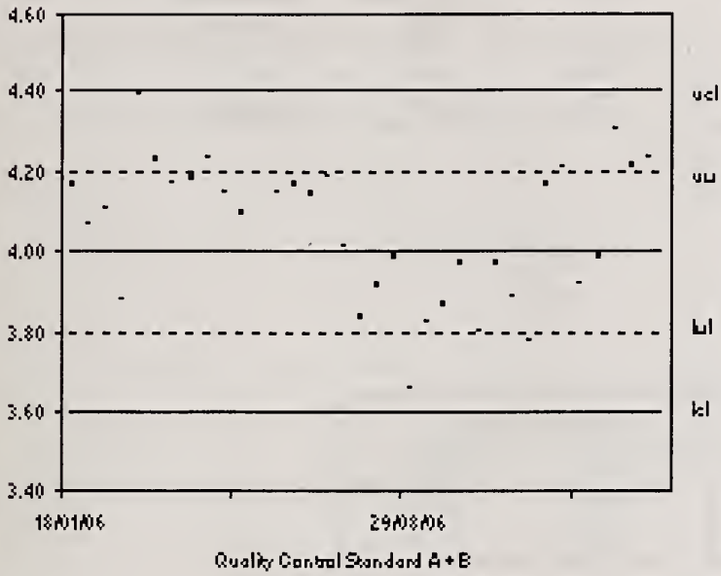
Number	Concentration	Std. Dev. (2)	% Coeff of Var
29	0 - 5.0	0.1718	14.8
3	5.1 - 10.0	0.2944	4.3
2	10.1 - 25.0	N/A	N/A
34	Total	0.2502	9.6

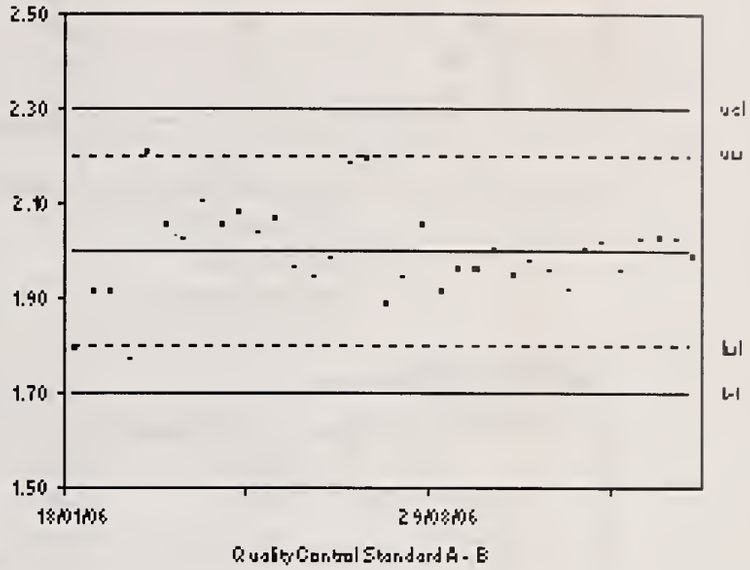
Other Checks	Number	Mean	Std. Dev. (1)
LTB	35	0.0140	0.0333
FB	35	0.0340	0.1088

CHLOROPHYLL "a" (E3169)

QUALITY CONTROL DATA FROM 01/12/06 TO 12/14/06

Reporting Unit: µg/L





CHLOROPHYLL "a" acidified, (E3169)
QUALITY CONTROL DATA FROM 01/05/2006 TO 12/29/2006
Reporting Unit: µg/L

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	34	2.4	2.63	0.23	0.1342
B	34	0.8	0.87	0.07	0.0712
A + B	34	3.2	3.50	0.30	0.1910
A - B	34	1.6	1.76	0.16	0.0983

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.11
	Within Runs	0.07
	Between/Within	1.54

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	3.00	3.40	2.81	3.59
A - B	1.40	1.80	1.30	1.90

Duplicates:

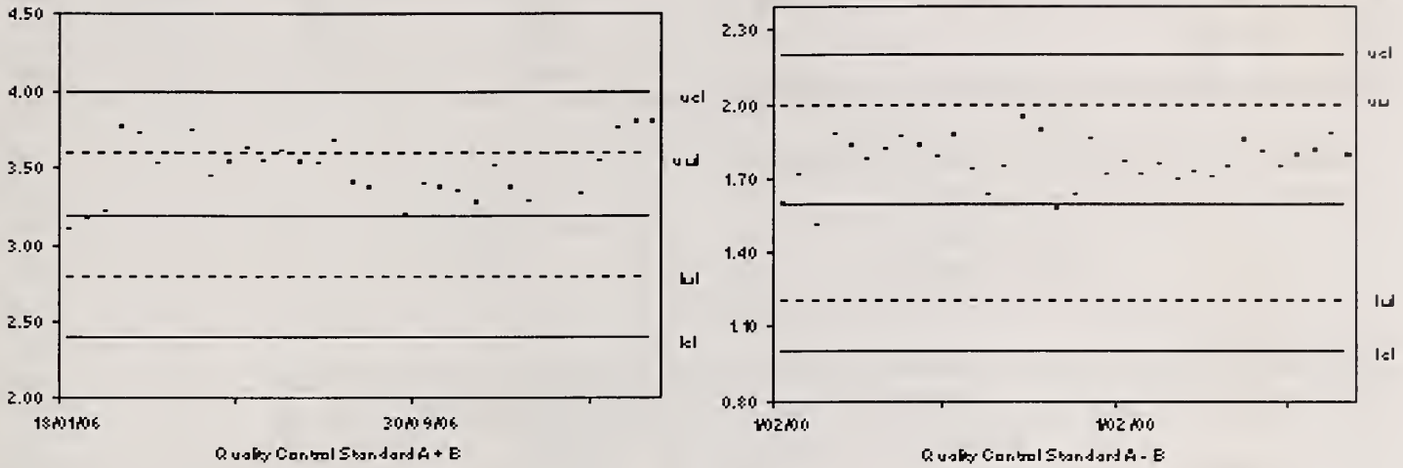
Number	Concentration	Std. Dev. (2)	% Coeff of Var
8	-0.5 - 1	0.389	132.8
4	1.1 - 2.0	0.2255	15.6
4	2.1 - 5.0	0.2284	9.4
1	5.1 - 10.0	N/A	N/A
5	10.1 - 100	1.1976	6.3
22	overall	0.6338	11.8

Other Checks	Number	Mean	Std. Dev. (1)
LTB	34	-0.0505	0.0363
FB	34	-0.0328	0.0591

CHLOROPHYLL "a", ACIDIFIED (E3169)

QUALITY CONTROL DATA FROM 01/12/06 TO 12/14/06

Reporting Unit: µg/L



CHLOROPHYLL "b" , (E3169)

QUALITY CONTROL DATA FROM 01/12/06 TO 12/14/06

Reporting Unit: µg/L

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	34	3.0	3.016	0.016	0.125
B	34	1.0	1.043	0.043	0.093
A + B	34	4.0	4.059	0.059	0.189
A – B	34	2.0	1.974	-0.026	0.113

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.11
	Within Runs	0.08
	Between/Within	1.38

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	3.77	4.23	3.55	4.45
A – B	1.77	2.23	1.66	2.34

Duplicates:

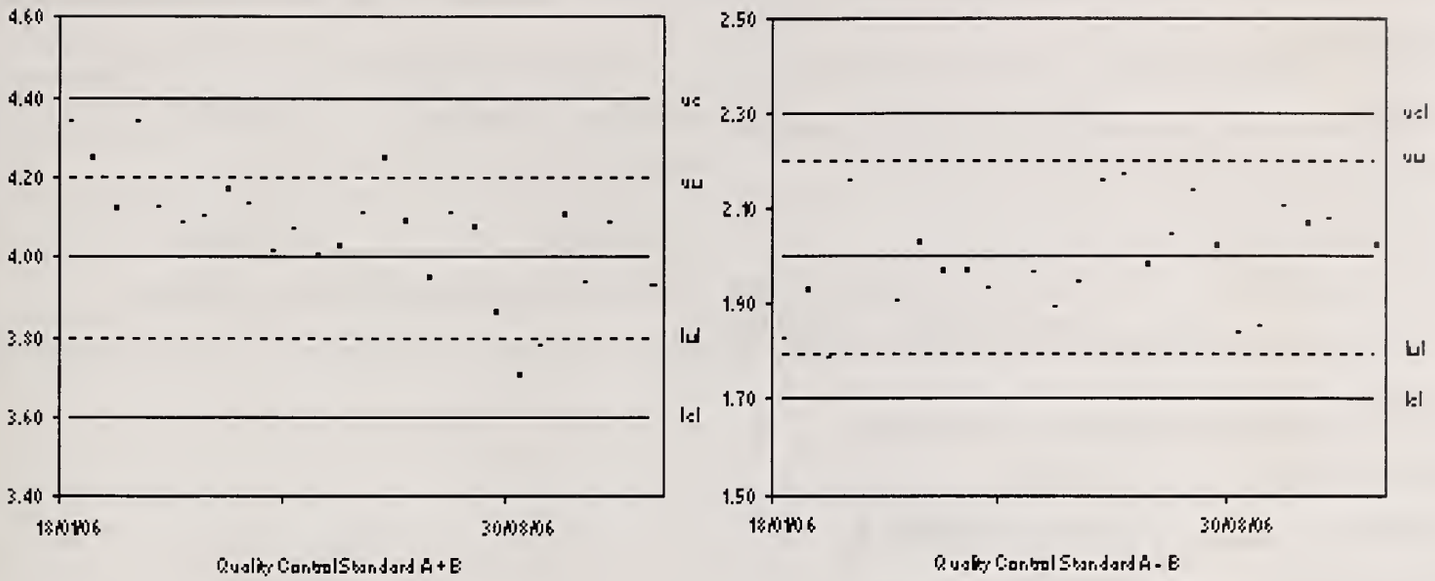
Number	Concentration	Std. Dev. (2)	% Coeff of Var
21	0 – 1.0	0.0731	32.5
4	1.1 – 2.0	0.1077	7.4
2	2.1 – 5.0	N/A	N/A.
27	Total	0.1799	29.0

Other Checks	Number	Mean	Std. Dev.
LTB	34	0.0061	0.0228
FB	34	0.0152	0.0653

CHLOROPHYLL "b" (E3169)

QUALITY CONTROL DATA FROM 01/12/06 TO 12/14/06

Reporting Unit: µg/L



COLOUR, TRUE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _ ☑ _ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	13/03/84
Method Reference No.	E3219	Reporting Unit	TCU
LIMS Product Code	COL3219	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

True colour is measured colourimetrically on the supernatant of a settled sample in a system calibrated with acidified chloroplatinate standards. The sample stream is measured using a broadband blue filter. Residual turbidity effects are suppressed by using a broadband red filter and increased path length in the reference stream.
Approximate absorbance: 0.3 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system. Colour measurement is through a 3.0 cm. light path using a broadband filter (400-450 nm). Turbidity measurement is through a 5.0 cm. light path using a different broadband filter (660-740 nm). Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 100 TCU

CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA
Drift	BL and standard after every 10 samples

NOTES:

The HP data capture/processing system was replaced by "Labtronics" Data Acquisition software in November 1998.

COLOUR; true (E3219)

QUALITY CONTROL DATA FROM 01/01/2006 TO 12/31/2006

Analytical Range: to 100 TCU

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	29	70	70.277	0.277	0.657
B	29	25	25.353	0.353	0.521
C	29	7.5	7.098	-0.402	0.466
A + B		95	95.63	0.63	0.928
A – B		45	44.924	-0.076	0.738
B + C		32.5	32.451	-0.049	0.908
B – C		17.5	18.256	0.756	0.391

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.593
	Within Runs	0.5218
	Between/Within	1.14
s.d.(BC)	Between Runs	0.4942
	Within Runs	0.2765
	Between/Within	1.79

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	93.59	96.11	92.18	97.82
A – B	43.59	46.46	42.89	47.11
B + C	31.57	33.43	30.65	34.35
B – C	16.52	18.43	16.11	18.89

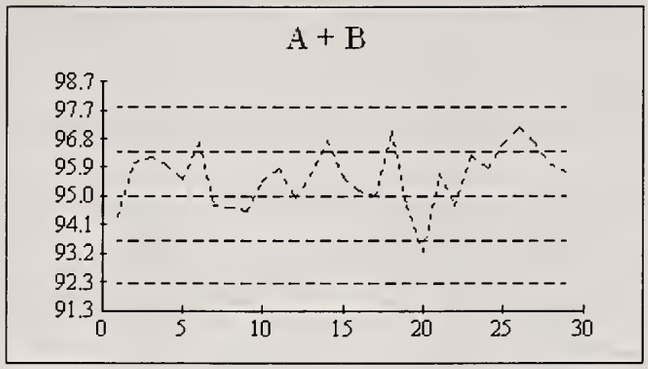
Duplicates:

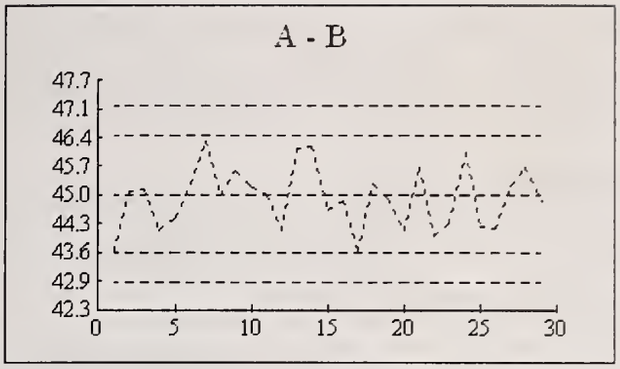
Number	Concentration	Std. Dev.	% Coeff of Var
53	0 – 10%	0.53	29.434
15	10 – 20%	0.701	5.088
6	20 – 50%	0.812	2.303
2	50 – 100%	N/A	N/A
76	Total	0.597	7.326

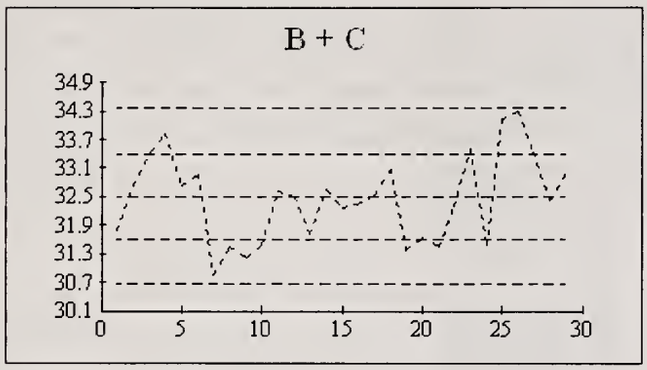
Other Checks	Number	Mean	Std. Dev.
LTB	29	-0.559	0.5

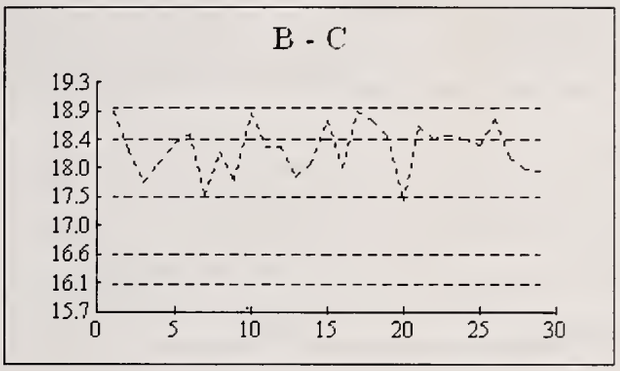
Colour;true (E3219)

QC Data; 1/1/2006 to 12/31/2006









CONDUCTIVITY

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _ ☑ _ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced:	01/04/74
Method Reference No:	E3218	Reporting Units:	µS/cm at 25^{0}C
LIMS Product Code:	PHALCO3218,CONDPH3218	Supervisor:	P. Wilson
Sample Type/Matrix:	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	50 mL
Container:	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

After equilibration at room temperature, the conductivity of the sample is measured. Temperature compensation is applied by the system. Total fixed endpoint alkalinity and pH are determined simultaneously.

INSTRUMENTATION:

Automated modular continual flow conductivity system comprising of a sampler and conductivity meter with cell plus computer control and data processing software.

REPORTING:

Max. Significant Figures: 3	Current W value: 1	Current T value: 5	Full Scale: 2000 µS/cm

CALIBRATION:

BL plus 1 standard

CONTROLS:

Calibration:	LTBL plus 4 standards, e.g. QCA
Drift:	In run standards throughout the run (tap water diluted to 50% V/V)

CONDUCTIVITY (E 3218)
Analytical Range: to 2000 µS/cm

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	95	1413	1410.19	-2.8102	3.7854
B	95	718	715.96	-2.0418	2.2744
C	95	147	147.34	0.3436	0.5970
D	95	34.1	37.86	0.7593	0.3427
A + B	95	2131	2126.15	-4.8500	4.3802
A – B	95	695	694.23	-0.7700	4.4518
B + C	95	865	863.30	-1.7000	2.4532
B – C	95	571	568.61	-2.3900	2.4245
C + D	95	184.1	185.20	1.1000	0.7964
C – D	95	109.9	109.48	-0.4200	0.5599

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	3.12
	Within Runs	3.15
	Between/Within	0.99
s.d.(BC)	Between Runs	1.66
	Within Runs	1.59
	Between/Within	1.05
s.d(CD)	Between Runs	0.49
	Within Runs	0.4
	Between/Within	1.23

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	2121.40	2143.60	2109.80	2152.20
A – B	684.40	705.60	679.10	710.90
B + C	858.45	871.55	851.90	878.10
B – C	564.47	577.53	561.20	580.80
C + D	182.07	186.03	180.04	188.160
C – D	107.84	111.92	106.86	112.94

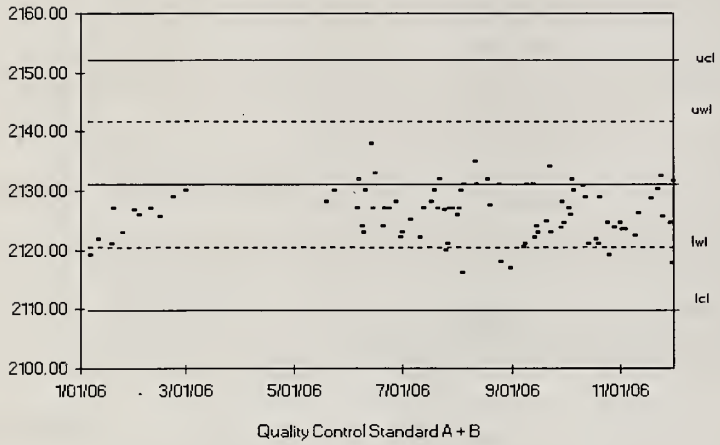
Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
57	0 – 200	1.6479	1.65
68	201 – 400	2.8323	1.86
109	401 – 1000	5.1576	0.82
31	1001 – 2000	7.6454	0.56
13	2001 – 10000	17.7943	0.56
278	Total	5.88	0.92

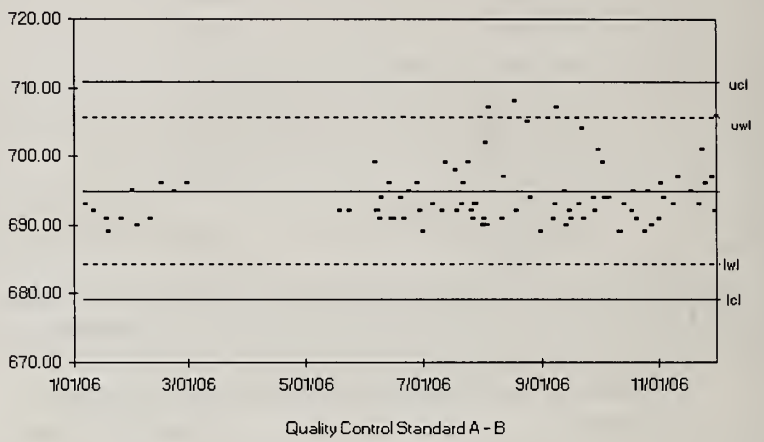
CONDUCTIVITY (E3218)

QUALITY CONTROL DATA FROM 01/06/06 TO 12/21/06

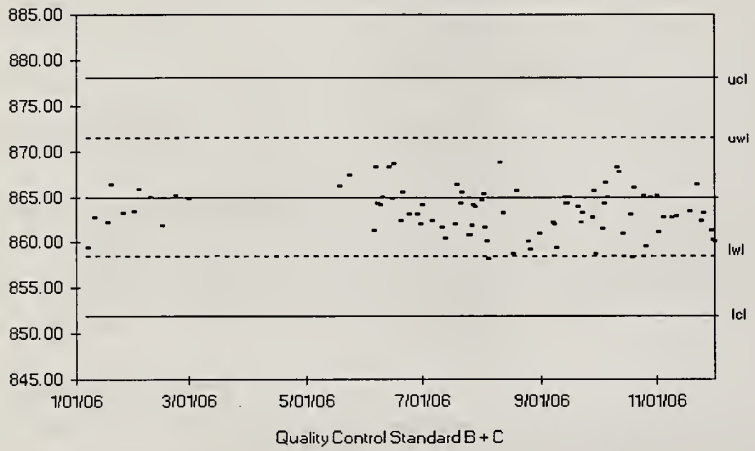
Analytical Range: to 2000 µS/cm



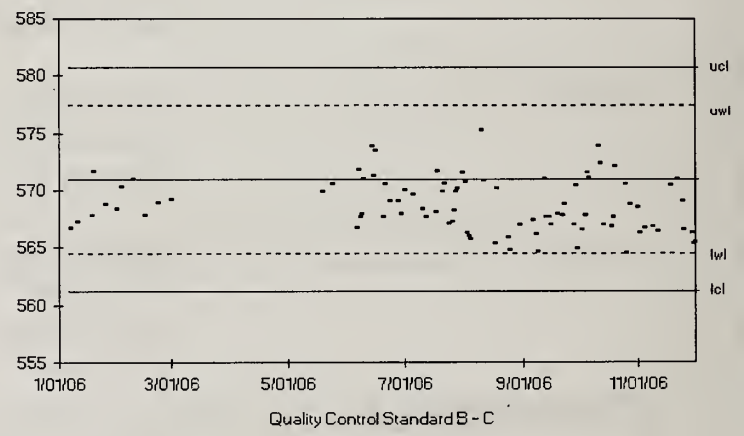
Quality Control Standard A + B



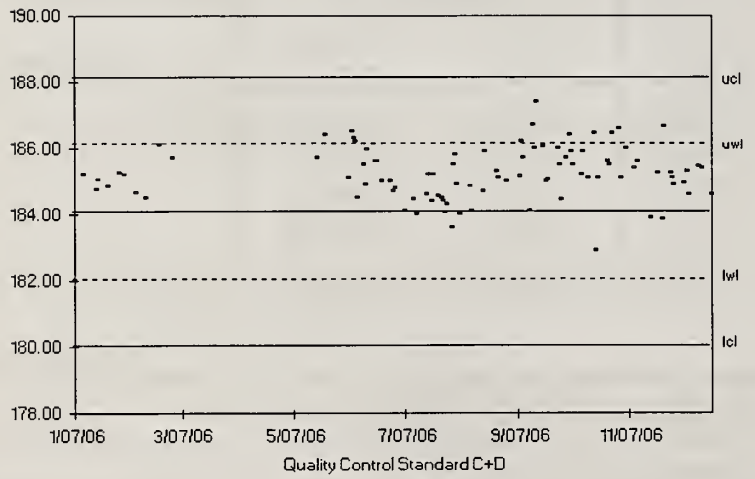
Quality Control Standard A - B



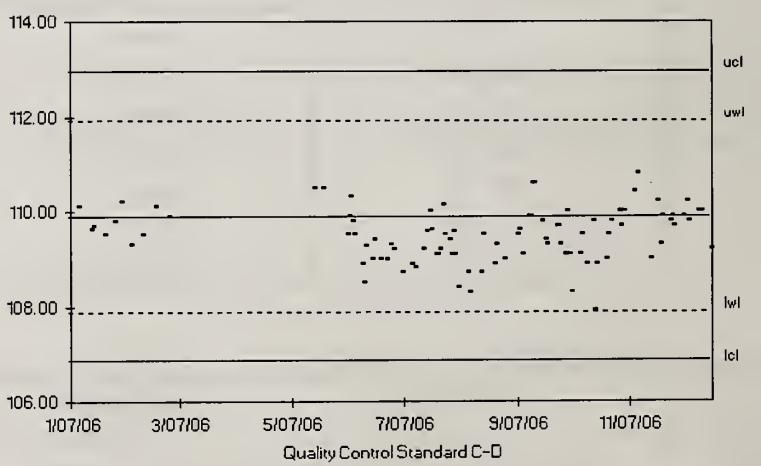
Quality Control Standard B + C



Quality Control Standard B - C



Quality Control Standard C+D



Quality Control Standard C-D

CYANIDE, FREE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _ ☑ _ No _____	Reportable Limit (OSDWA): 0.2 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/98
Method Reference No.	E3015	Reporting Unit	Aqueous: mg/L as CN Solid: µg/g as CN
LIMS Product Code	CNF3015	Supervisor	P. Wilson
Sample Type/Matrix	**Aqueous:** Surface Water, Drinking Water, Ground Water, Raw Sewage & Effluent, Industrial Effluent. **Solid:** Sediment, Dried Sludge, Industrial Waste		

SAMPLING:

Quantity Required:	**Aqueous**: 500 mL + 10 drops of 50% w/v NaOH **Solid** : 5 g, minimum
Container:	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Free cyanides are the simple and weakly dissociable cyanides which form HCN upon acidification to pH4.0 (such as HCN and KCN). The automated determination of free cyanide exposes the sample to distillation which isolates HCN under specific acidic conditions. A zinc sulphate solution is included which eliminates interference from complexed iron cyanides. Cyanide is determined colourimetrically by the reaction of cyanide with chloramine –T to form cyanogen chloride which further reacts with a combination of barbituric acid and isonicotinic acid to form a highly coloured coupling product, which is measured at 600 nm.

Aqueous samples are introduced directly to the continuous flow system by an autosampler.
Solid samples are extracted in a sodium hydroxide solution with mechanical shaking for 6 to 8 hours and then centrifuged. The supernatant is decanted, diluted if necessary to eliminate interference from colour and introduced to the continuous flow system by the autosampler. Solid samples are not dried or ground, but weighed and extracted as received, to prevent the loss of simple cyanides. If the sample is wet, results are reported as µg/g wet and moisture content is reported by a separate method.

CYANIDE, FREE cont'd

INSTRUMENTATION:

Skalar automated segmented flow colourimetric system, measurement through a 500 mm light path at 600nm.

Skalar data capture and data processing software with computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.001 mg/L 0.01 µg/g	Current T value: 0.005mg/L 0.05 µg/g	Full Scale: 0.2 mg/L

CALIBRATION:

BL plus 6 standards (S0 to S5)

CONTROLS:

Calibration:	LTB plus 2 standards , e.g. QCA
Drift:	BL and check standards

NOTES:

December 2002, vegetation matrix removed.

CYANIDE, FREE (E3015)

QUALITY CONTROL DATA FROM 01/06/06 TO 12/22/06

Analytical Range: to 0.2 mg/L as CN

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	15	0.15	0.1486	-0.0014	0.0021
B	15	0.02	0.0195	-0.0005	0.0005
A + B	15	0.17	0.1681	-0.0019	0.0024
A – B	15	0.13	0.1291	-0.0088	0.0019

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0015
	Within Runs	0.0014
	Between/Within	1.16

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	0.162	0.178	0.154	0.186
A – B	0.122	0.138	0.118	0.142

	Number	Expected	Mean	Mean Bias	Std. Dev.(1)
KCN	15	0.1	0.0893	-0.0107	0.0245
FeCN	15	<0.001*	0.0008	-0.099	0.0009

*** 2000 to 2006 data**

FeCN is not expected to be detected for free cyanide. Results should be <= w or <0.001 although standard tested is 0.10 mg/L.

Duplicates:

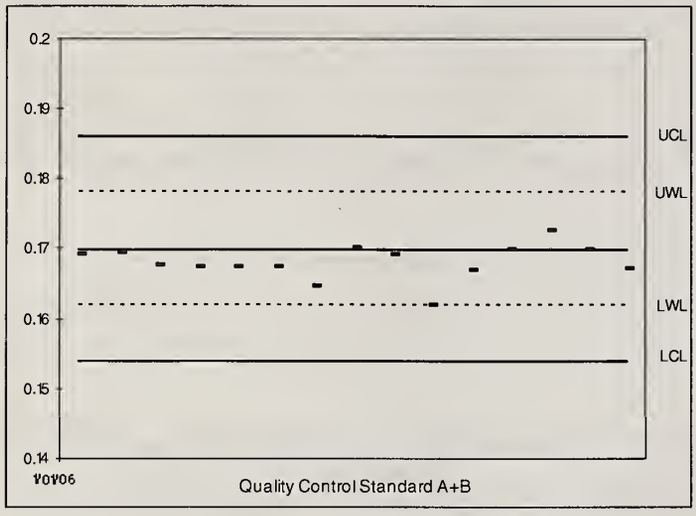
Number	Concentration	Std. Dev.	% Coeff of Var
17	0 – 0.020	0.0012	19
2	0.021 – 0.040	NA	NA
1	0.041 – 0.100	N/A	N/A
0	0.101 – 0.200	N/A	N/A
20	overall	0.008835	

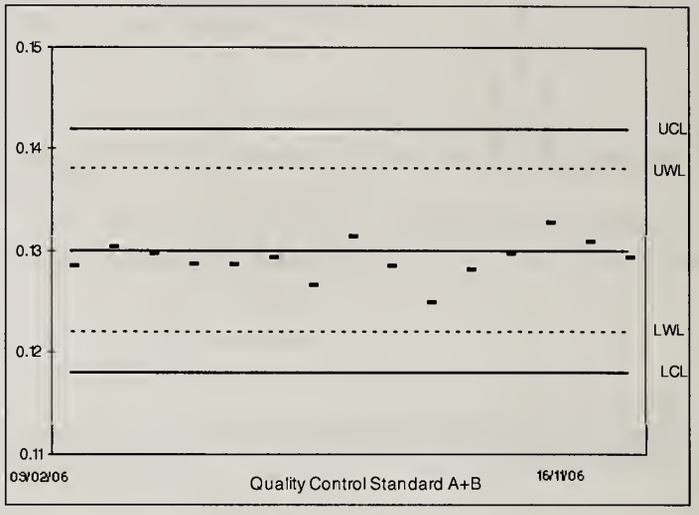
Other Checks	Number	Mean	Std. Dev.
LTB	14	0.001929	0.000709

CYANIDE, FREE (E3015)

QUALITY CONTROL DATA FROM 01/06/06 TO 12/22/06

Analytical Range: to 0.2 mg/L as CN





CYANIDE, TOTAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status: ☑ Yes _ ☑ _ No _____	Licensed (Drinking Water): ☑ Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/98
Method Reference No.	E3015	Reporting Unit	Aqueous: mg/L as CN Solid: µg/g as CN
LIMS Product Code	CN3015, TCLPCN3015	Supervisor	P. Wilson
Sample Type/Matrix	**Aqueous:** Surface Water, Drinking Water, Ground Water, Raw Sewage & Effluent, Industrial Effluent. **Solid:** Soil, Sediment, Dried Sludge, Industrial Waste		

SAMPLING:

Quantity Required:	Aqueous: 500 mL + 10 drops of 50% w/v NaOH **Solid** : 5 g, minimum
Container:	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Total cyanides include free, simple (HCN,KCN) and weakly dissociable cyanides ($Ni(CN)_4$) as well as those complexed cyanides that decompose to form free cyanides that distill out as HCN in an acidic environment. The automated determination of total cyanide exposes the sample to ultraviolet radiation to break down organic metallic and alkali-complexed cyanide compounds to free cyanide. The distillation step isolates HCN under specific acidic conditions. The sequential combination of UV digestion plus distillation yields the measurement of "total cyanide". Cyanide is measured colourimetrically by the reaction of cyanide with chloramine –T to form cyanogen chloride which further reacts with a combination of barbituric acid and isonicotinic acid to form a highly coloured coupling product, which is measured at 600 nm.

Aqueous samples are introduced directly to the continuous flow system from an autosampler.
Solid samples are extracted in a sodium hydroxide solution with mechanical shaking for 6 to 8 hours, then centrifuged. The supernatant is then decanted, diluted if necessary to eliminate interference from colour and introduced to the continuous flow system by the autosampler. Solid samples are not dried or ground, but weighed and extracted as received, to prevent the loss of simple cyanides. If the sample is wet, results are reported as µg/g wet and moisture content is reported by a separate method.

INSTRUMENTATION:

Skalar automated segmented flow colourimetric system, measurement through a 500 mm light path at 600 nm. Skalar data capture and data processing software with computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.001 mg/L 0.01 µg/g	Current T value: 0.005mg/L 0.05 µg/g	Full Scale: 0.2 mg

CALIBRATION:

BL plus 6 standards (S0 to S5)

CONTROLS:

Calibration:	LTB plus 2 standards , e.g. QCA
Drift:	BL and check standards

NOTES:

TCLPCN3015, LIMS product code was added on April 2001.

CYANAIDE, TOTAL (E3015)

QUALITY CONTROL DATA FROM 01/09/06 TO 09/28/06

Analytical Range: to 0.2 mg/L as CN

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev. (1)
A	19	0.15	0.1471	-0.0029	0.0012
B	19	0.02	0.0191	-0.0009	0.0048
A + B	19	0.17	0.1662	-0.0038	0.0014
A – B	19	0.13	0.1281	-0.0019	0.0012

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.001
	Within Runs	0.001
	Between/Within	1.03

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	0.162	0.178	0.154	0.186
A – B	0.122	0.138	0.118	0.142

Reference Material:

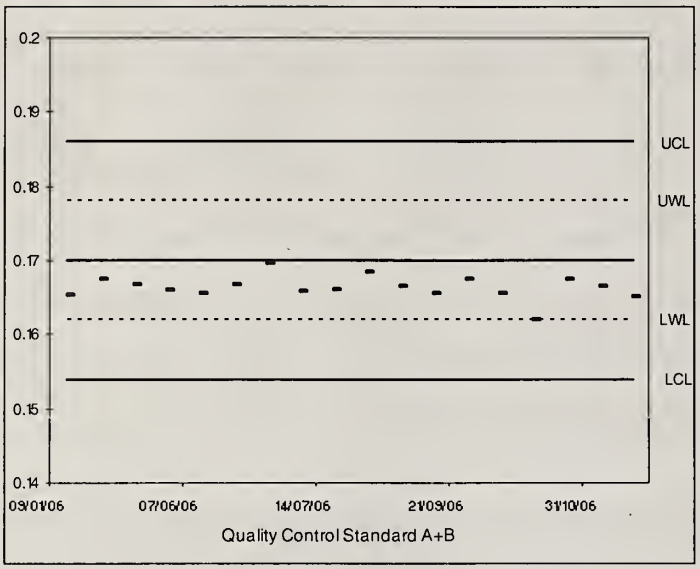
	Number	Expected	Mean	Mean Bias	Std. Dev. (1)
KCN	19	0.1	0.1425	0.0425	0.1965
FeCN	19	0.1	0.1356	0.0356	0.0233

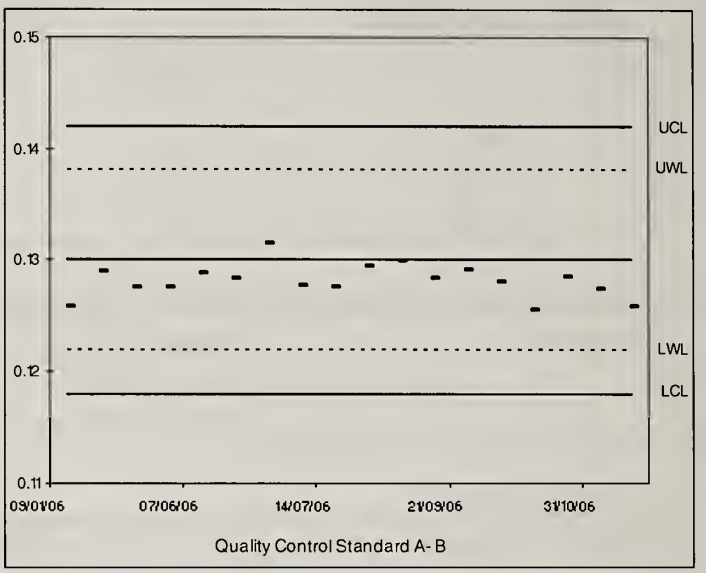
Duplicates:

Number	Concentration	Std. Dev. (2)	% Coeff of Var
21	0 – 0.020	0.0004	19
1	0.021 – 0.040	N/A	N/A
6	0.041 – 0.100	0.0191	3.7
0	0.101 – 0.200	N/A	N/A
28	overall	0.008835	7.481526

Other Checks	Number	Mean	Std. Dev. (2)
LTB	19	-0.000095	0.00621

TOTAL CYANIDE (mg/L as CN)
QUALITY CONTROL DATA FROM 01/09/06 TO 09/28/06
E3015





FLUORIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water) ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): 1.5 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	October 2001
Method Reference No	E3172	Reporting Unit	mg/L as F
LIMS Product Code	F3172, ANION3172, TCLPF3172	Supervisor	P. WILSON
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Drinking Water, Ground Water, Leachate, Surface Water, Raw Sewage, Sediment, Dried Sludge, Unknown Material, Soil		

SAMPLING:

Quantity Required	50 mL
Container	Plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Fluoride is separated from other anions in the samples by automated suppressed ion chromatography using an eluent mixture of 0.0010 M sodium bicarbonate and 0.0035 M sodium carbonate with conductivity detector. The concentration of fluoride in mg/L as F^- is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system, Justice Innovation ChromPerfect Spirit Data Station, plus control module (in-house design) for the automated sample introduction, timing and detector range switching.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.01	Current T value: 0.05	Full Scale: 2.0 mg/L

CALIBRATION:

BL plus 9 standards

CONTROLS:

Calibration	LTB plus 3 standards, e.g. QCA
Drift	CHK1 and CHK2 standard approximately every 20 samples

NOTES:

This method replaced E3369, October 2001.

Method E3369 calibration control values were used to establish initial control limits for the present method.

LIMS product code TCLPF3172 was added, October 2001.

FLUORIDE (E3172)

QUALITY CONTROL DATA FROM 01/07/06 TO 12/23/06

Analytical Range: to 2.0 mg/L

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	43	1.60	1.60	0.00	0.0142
B	43	0.80	0.81	0.01	0.0107
C	43	0.16	0.17	0.01	0.0068
A + B	43	2.40	2.41	0.01	0.0194
A – B	43	0.80	0.79	-0.01	0.0157
B + C	43	0.96	0.98	0.02	0.0138
B – C	43	0.64	0.64	0.00	0.1119

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.013
	Within Runs	0.011
	Between/Within	1.12
s.d.(BC)	Between Runs	0.009
	Within Runs	0.008
	Between/Within	1.12

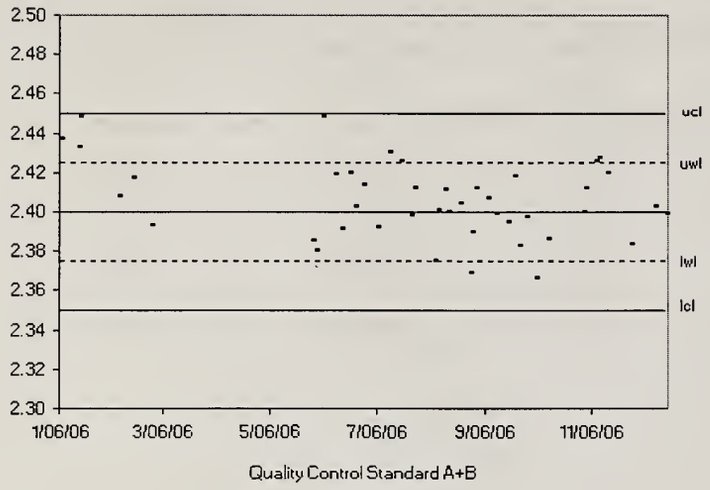
Control Limits:

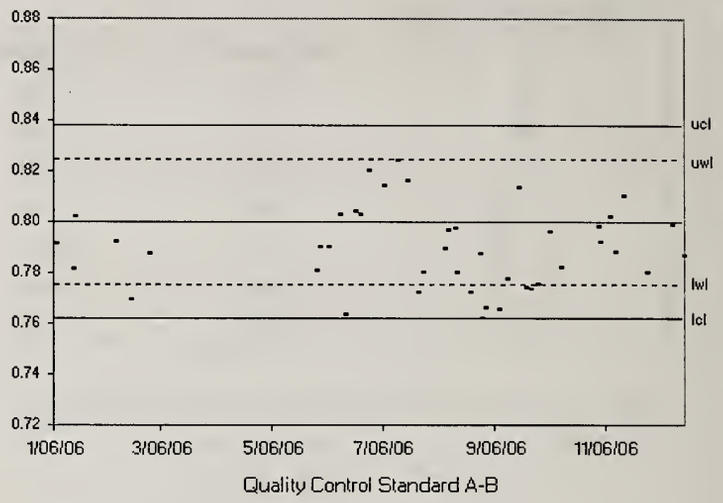
Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	2.375	2.250	2.350	2.450
A – B	0.768	0.833	0.762	0.838
B + C	0.937	0.983	0.914	1.006
B – C	0.617	0.663	0.606	0.674

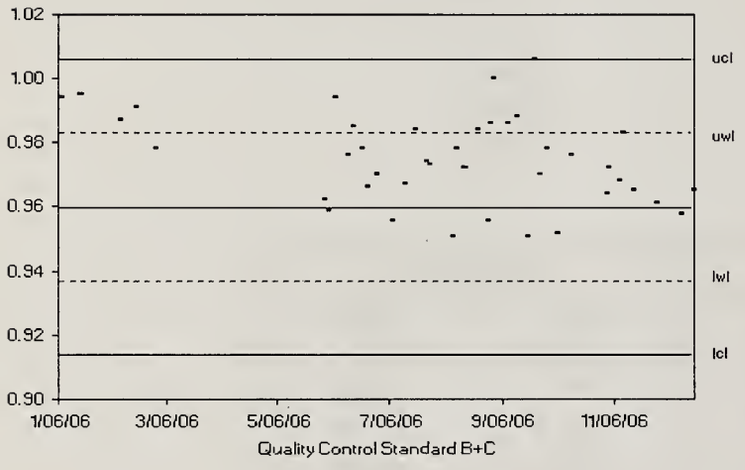
Duplicates:

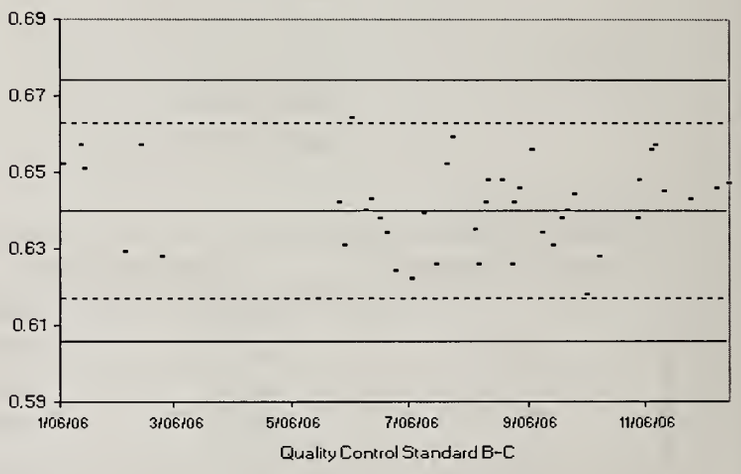
Number	Concentration	Std. Dev.	% Coeff. Of Var.
67	0.00 – 0.10	0.0052	10.15
13	0.11 – 0.20	0.0043	3.4
14	0.21 – 0.40	0.0078	2.3
27	0.41 – 1.00	0.011	1.7
6	1.01 – 2.00	0.0247	1.7
127	Total	0.0088	3.3

FLUORIDE (E3172)
QUALITY CONTROL DATA FROM 01/07/06 TO 12/23/06
Analytical Range: to 2.0 mg/L as F









NITRATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water) : N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Units	$\mu g/m^3$ as NO_3
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	¾" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube
Preservative(s)	None

SAMPLING PREPARATION:

A ¾" strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Nitrate separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of nitrate (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation is made. The result is reported as $\mu g/m^3$ as NO_3.
Chloride and sulphate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.1 $\mu g/m^3$	Current T value: 0.5 $\mu g/m^3$	Full Scale: 28.6 $\mu g/m^3$

CALIBRATION:

9 standards

CONTROLS:

Calibration	MB, QCA and QCB
Drift	2 standards every 20 samples
Recovery	CS4 & CS5

NOTES:

To convert unit from mg/L to $\mu g/m^3$, the final concentration of NO_3 in $\mu g/m^3$ is calculated by the following formula:

$$\text{Result (mg/L) X 50mL X (63/6.75) / air volume} = \mu g/m^3$$

Where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

Calibration control status and in house control standards are reported in mg/L.

NITRATE (E3004)

QUALITY CONTROL DATA FROM 01/05/2006 TO 9/24/2006

Analytical Range: to 28.6 µg/m³ (100 mg/L) as NO_3

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
***A**	8	80	80.4981	0.4981	0.4379
***B**	8	20	20.0951	0.0951	0.2430
***A + B**	8	100	100.5933	0.5933	0.6358
***A – B**	8	60	60.4030	0.4030	0.3121

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.35
	Within Runs	0.22
	Between/Within	1.6

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
*A + B	98.30	101.70	96.61	103.39
*A – B	58.30	61.70	57.46	62.54

In House Control standard for 01/05/06 to 09/24/2006

	Number	Expected	Mean	Mean Bias	Std. Dev. (1)
*CS4	8	11.97	11.82	-0.15	0.4655
*CS5	8	16.19	16.02	-0.17	0.4338

The calibration is accepted if the calibration control values obtained lie within the range:

10.73 - 13.21 for CS4

15.13 - 17.25 for CS5

Duplicates:

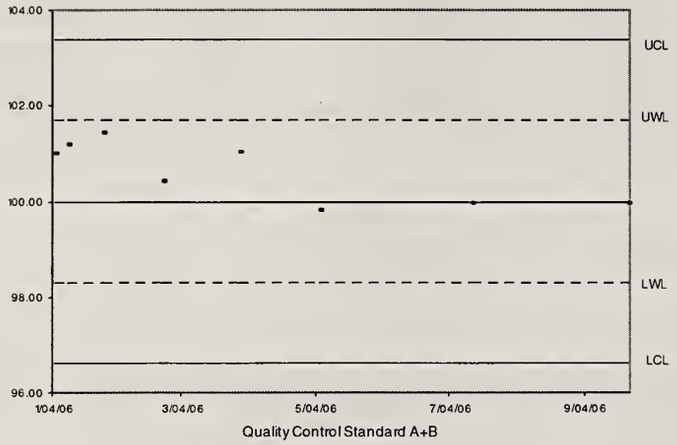
Number	Concentration	Std. Dev.	% Coeff of Var
13	0.0 – 2.86	0.067	3.3
4	2.89 – 7.15	0.2267	6.1
2	7.18 – 14.31	N/A	N/A
0	14.33 – 28.61	N/A	N/A
19	Total	0.1087	

*Results reported in mg/L

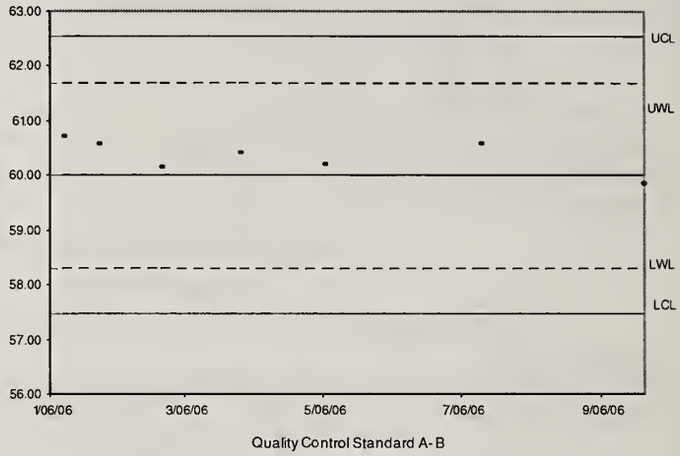
NITRATE (E3004)

QUALITY CONTROL DATA FROM 01/05/2006 TO 12/26/2006

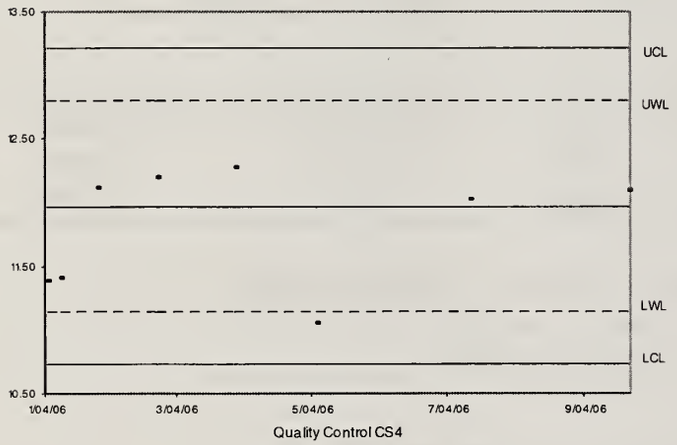
Analytical Range: to 100 mg/L as NO_3



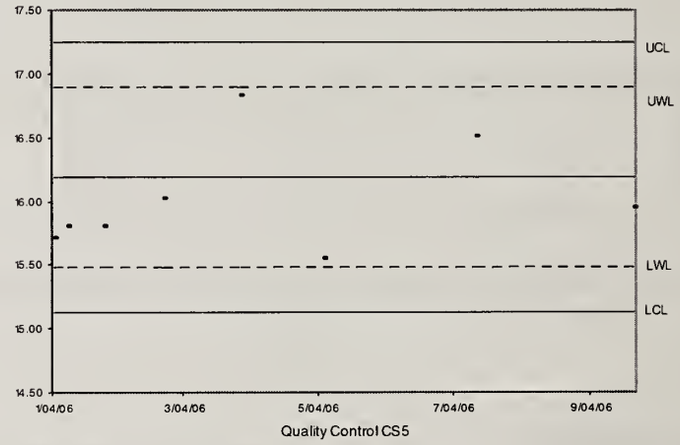
Quality Control Standard A+B



Quality Control Standard A-B



Quality Control CS4



Quality Control CS5

NITRILOTRIACETIC ACID

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No ____	Reportable Limit (OSDWA): 0.4 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	04/17/98
Method Reference No.	E3406	Reporting Unit	mg/L as NTA
LIMS Product Code	NTA3406, TCLPNTA3406	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water for NTA3406; unknown, dried sludge, sediment, soil and industrial waste for TCLPNTA3406		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Nitrilotriacetic Acid is separated from other anions in the samples by automated suppressed gradient ion chromatography. A sodium hydroxide eluent is used with conductivity detection. The concentration of Nitrilotriacetic acid in mg/L as NTA is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system with gradient flow control module .

REPORTING:

Max. Significant Figures: 3	Current W value: 0.01	Current T value: 0.05	Full Scale: 1.00 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA
Drift	1 standard every 10 samples
Spike	1 blank plus 3 samples

NOTES:

LIMS product code TCLPNTA3406 was added, April 2001.

NITRILOTRIACETIC ACID (E3406)

QUALITY CONTROL DATA FROM 01/26/2006 TO 12/08/2006

Analytical Range: to 1.00 mg/L as NTA

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	10	0.8	0.8038	0.0038	0.0060
B	10	0.2	0.2067	0.0067	0.0079
A + B	10	1	1.0104	0.0104	0.0116
A – B	10	0.6	0.5971	-0.0029	0.0079

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0074
	Within Runs	0.0059
	Between/Within	1.26

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	0.98	1.03	0.95	1.05
A – B	0.57	0.63	0.56	0.64

Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
23	0.00 – 0.10	0.0114	31.8
1	0.11 – 0.20	N/A	N/A
0	0.21 – 0.50	N/A	N/A
0	0.51 – 1.00	N/A	N/A
24	Total	0.0112	28.6

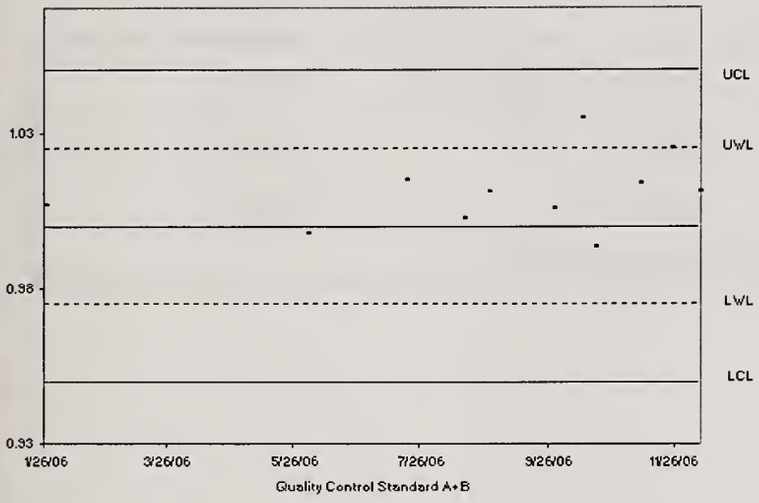
Recoveries:

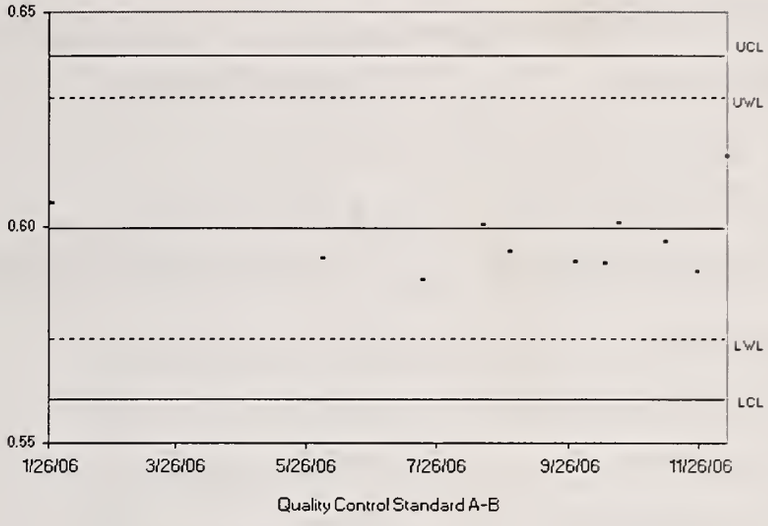
	Number	Expected	Mean	Std. Dev. (1)
Spiking Standard	30	0.1	0.1058	0.0088

Nitrilotriacetic Acid (E3406)

QUALITY CONTROL DATA FROM 01/26/2006 TO 12/08/2006

Analytical Range: to 1.00 mg/L as NTA





NITROGEN, AMMONIA PLUS AMMONIUM

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative (s)	None

ANALYTICAL PROCEDURE:

Ammonia plus ammonium ions are determined on the supernatant of a settled sample via the formation of indophenol blue in a buffered system using nitroprusside as a catalyst. A reference stream, which differs from the colour formation stream by replacement of the catalyst with an equal flow of water, is employed to suppress sample matrix effects.
Approximate absorbance: 0.5 at the full scale level.
Nitrate plus nitrite, nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus two 38°C heating baths (7.7 mL delay).
Colourimetric measurement is through a 1.5 cm. light path at 630 nm.
Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.002	Current T value: 0.010	Full Scale: 2 mg/L

CALIBRATION:

BL plus 7 standards

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL, standard, and BL after every 10 samples

NOTES:

The HP data capture / processing system was replaced by "Labtronics" Data Acquisition software in August 1999.

NITROGEN, AMMONIA + AMMONIUM (E3364)

QUALITY CONTROL DATA FROM 01/01/2006 TO 12/31/2006

Analytical Range: to 2 mg/L

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	62	1.6	1.609	0.009	0.013
B	62	0.8	0.802	0.002	0.008
C	62	0.16	0.161	0.001	0.006
A + B		2.4	2.411	0.011	0.017
A - B		0.8	0.807	0.007	0.012
B + C		0.96	0.963	0.003	0.01
B - C		0.64	0.641	0.001	0.009

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0104
	Within Runs	0.0085
	Between/Within	1.22
s.d.(BC)	Between Runs	0.0068
	Within Runs	0.0064
	Between/Within	1.06

Control Limits

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	2.376	2.424	2.353	2.447
A - B	0.776	0.824	0.765	0.835
B + C	0.945	0.974	0.933	0.989
B - C	0.626	0.654	0.618	0.662

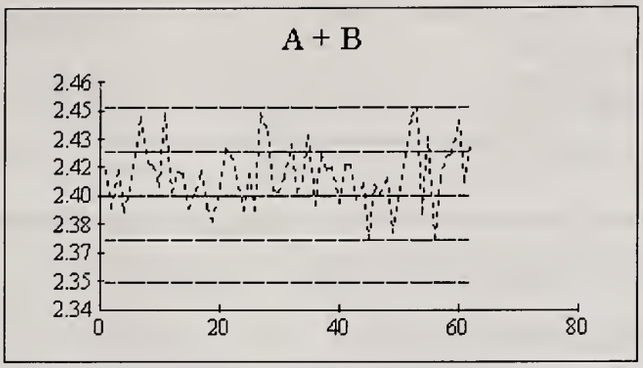
Duplicates:

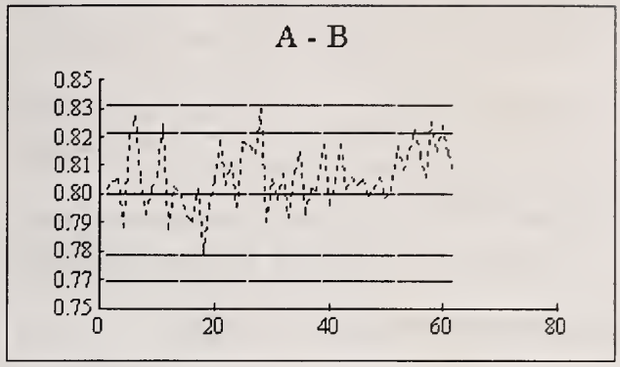
Number	Concentration	Std. Dev.	% Coeff of Var
158	0 - 10%	0.006	39.187
4	10 - 20%	0.085	36.761
0	20 - 50%	N/A	N/A
0	50 - 100%	N/A	N/A
162	Total	0.015	72.665

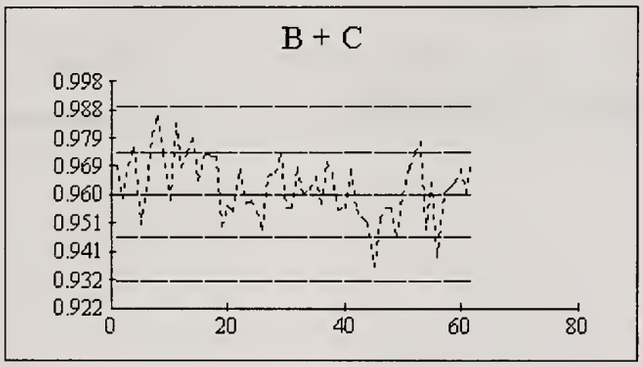
Other Checks	Number	Mean	Std. Dev.
LTB	61	0.002	0.009

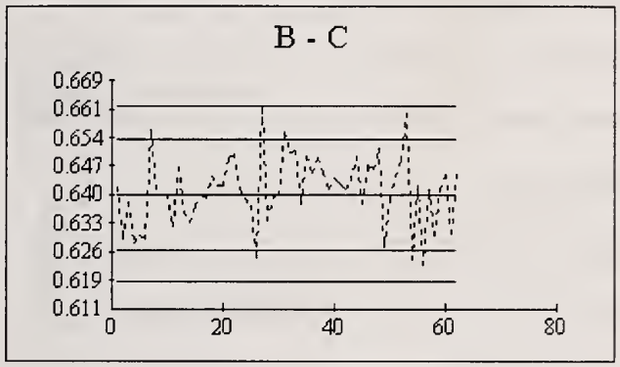
Nitrogen; ammonia+ammonium (E3364)

QC Data; 1/1/2006 to 12/31/2006









NITROGEN, AMMONIA PLUS AMMONIUM

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/77
Method Reference No.	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water and Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Ammonia plus ammonium ions are determined on the supernatant of a settled sample via the formation of indophenol blue in a buffered system using nitroprusside as a catalyst.
Approximate absorbance: 0.7 at the full scale level.
Reactive orthophosphate, nitrogen-nitrite and nitrogen-nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus one 38^0C heating bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 630 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.05	Current T value: 0.25	Full Scale: 50 mg/L

CALIBRATION:

BL plus 7 standards

NITROGEN, AMMONIA PLUS AMMONIUM cont'd

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL , standard and BL every 10 samples

NOTES:

The HP capture / processing system was replaced by "Labtronics" Data Acquisition software in October 1999.

Surface Water matrix was added in October 2005.

NITROGEN; AMMONIA + AMMONIUM (E3366)
QUALITY CONTROL DATA FROM 01/01/2006 TO 12/31/2006
Analytical Range: to 50 mg/L

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	31	40	40.1	0.1	0.322
B	31	20	20.252	0.252	0.115
C	31	4	4.025	0.025	0.094
A + B		60	60.352	0.352	0.321
A - B		20	19.848	-0.152	0.361
B + C		24	24.276	0.276	0.162
B - C		16	16.227	0.227	0.134

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.2415
	Within Runs	0.2553
	Between/Within	0.95
s.d.(BC)	Between Runs	0.1051
	Within Runs	0.0948
	Between/Within	1.11

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	59.38	60.62	58.76	61.2
A - B	19.38	20.62	19.07	20.9
B + C	23.67	24.33	23.34	24.7
B - C	15.67	16.33	15.5	16.5

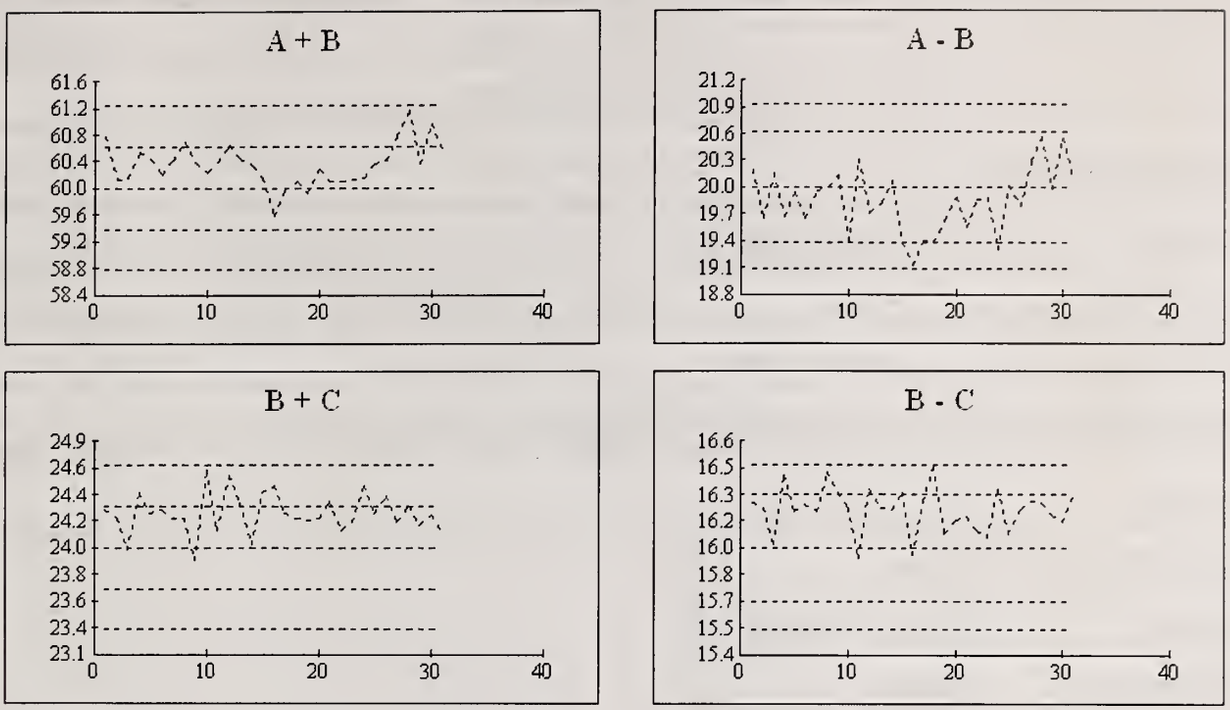
Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
59	0 - 10%	0.074	12.868
8	10 - 20%	0.045	0.698
10	20 - 50%	0.197	1.177
0	50 - 100%	N/A	N/A
77	Total	0.097	2.953

Other Checks	Number	Mean	Std. Dev.
LTB	31	-0.011	0.04

Nitrogen; ammonia+ammonium (E3366)

QC Data; 1/1/2006 to 12/31/2006



NITROGEN, NITRATE PLUS NITRITE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water) ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): 10 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservation (s)	None

ANALYTICAL PROCEDURE:

Nitrate plus nitrite is determined on the supernatant of a settled sample. Nitrate is reduced to nitrite in alkaline media at 37°C, by hydrazine sulphate with copper as a catalyst. Colourimetry is based on the formation of an azo dye by nitrite, sulphanilamide, and N(1-napthyl) ethylenediamine dihydrochloride. To control metal ion interference, samples are passed through an ion-exchange column prior to the reduction step. Approximate absorbance: 0.6 at the full scale level. Ammonia plus ammonium, nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: 38°C heating bath (7.7 mL delay), ion exchange column. Colourimetric measurement is through a 1.5 cm. light path at 520 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.005	Current T value: 0.025	Full Scale: 5 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL , standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:

The HP data capture / processing system was replaced by "Labtronics" Data Acquisition software in August 1999.

Concentration range was extended from 5 mg/L to 12.008 mg/L in October 2006.

NITROGEN; NITRATE + NITRITE (E3364)

QUALITY CONTROL DATA FROM 1/1/2006 TO 10/31/2006

Analytical Range: to 5 mg/L as N

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	47	4	4.018	0.018	0.035
B	47	2	2.009	0.009	0.02
C	47	0.4	0.395	-0.005	0.009
A + B		6	6.027	0.027	0.042
A - B		2	2.008	0.008	0.038
B + C		2.4	2.405	0.005	0.025
B - C		1.6	1.614	0.014	0.017

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0285
	Within Runs	0.0269
	Between/Within	1.06
s.d.(BC)	Between Runs	0.0151
	Within Runs	0.0120
	Between/Within	1.26

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	5.923	6.077	5.847	6.153
A - B	1.923	2.077	1.885	2.115
B + C	2.366	2.434	2.332	2.468
B - C	1.566	1.634	1.549	1.651

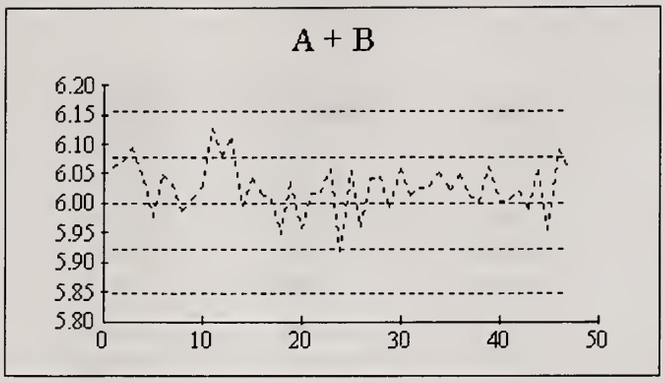
Duplicates:

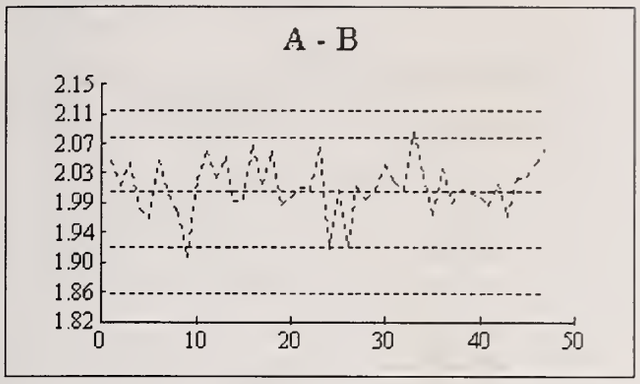
Number	Concentration	Std. Dev.	% Coeff of Var
91	0 - 10%	0.008	4.784
19	10 - 20%	0.153	22.999
10	20 - 50%	0.053	3.506
8	50 - 100%	0.045	1.313
128	Total	0.062	11.275

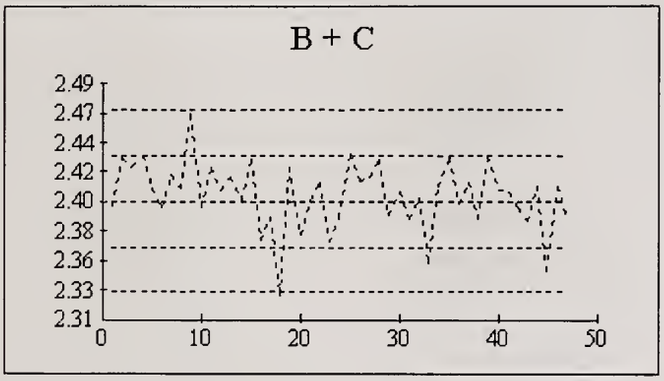
Other Checks	Number	Mean	Std. Dev.
LTB	46	0.001	0.02

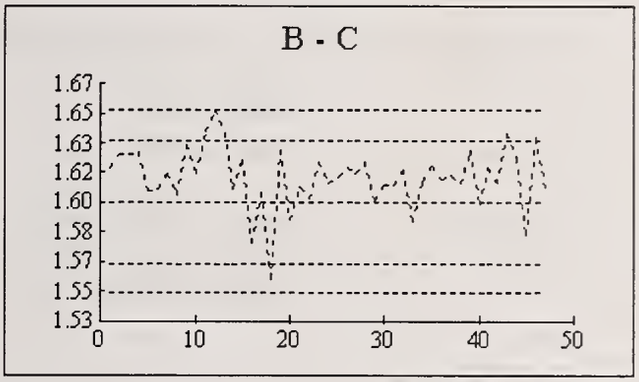
Nitrogen; nitrate+nitrite [E3364]

QC Data; 2006/1/1 to 2006/10/31









NITROGEN; NITRATE + NITRITE
QUALITY CONTROL DATA FROM 11/01/2006 TO 12/31/2006
Analytical Range: to 12 mg/L

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	15	9.530	9.565	0.035	0.0618
B	15	4.760	4.771	0.011	0.0390
C	15	0.953	0.950	-0.003	0.0148
A + B		14.29	14.336	0.046	0.0561
A - B		4.770	4.794	0.024	0.0868
B + C		5.713	5.721	0.008	0.0366
B - C		3.807	3.821	0.014	0.0463

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0517
	Within Runs	0.0614
	Between/Within	0.84
s.d.(BC)	Between Runs	0.0295
	Within Runs	0.0327
	Between/Within	0.90

Control Limits

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	14.150	14.430	14.010	14.570
A - B	4.633	4.907	4.564	4.976
B + C	5.005	6.421	4.297	7.129
B - C	3.099	4.515	3.745	4.869

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
19	0 - 10%	0.015	7.761
5	10 - 20%	0.020	2.809
9	20 - 50%	0.020	1.132
3	50 - 100%	0.029	0.902
41	Total	0.055	3.285

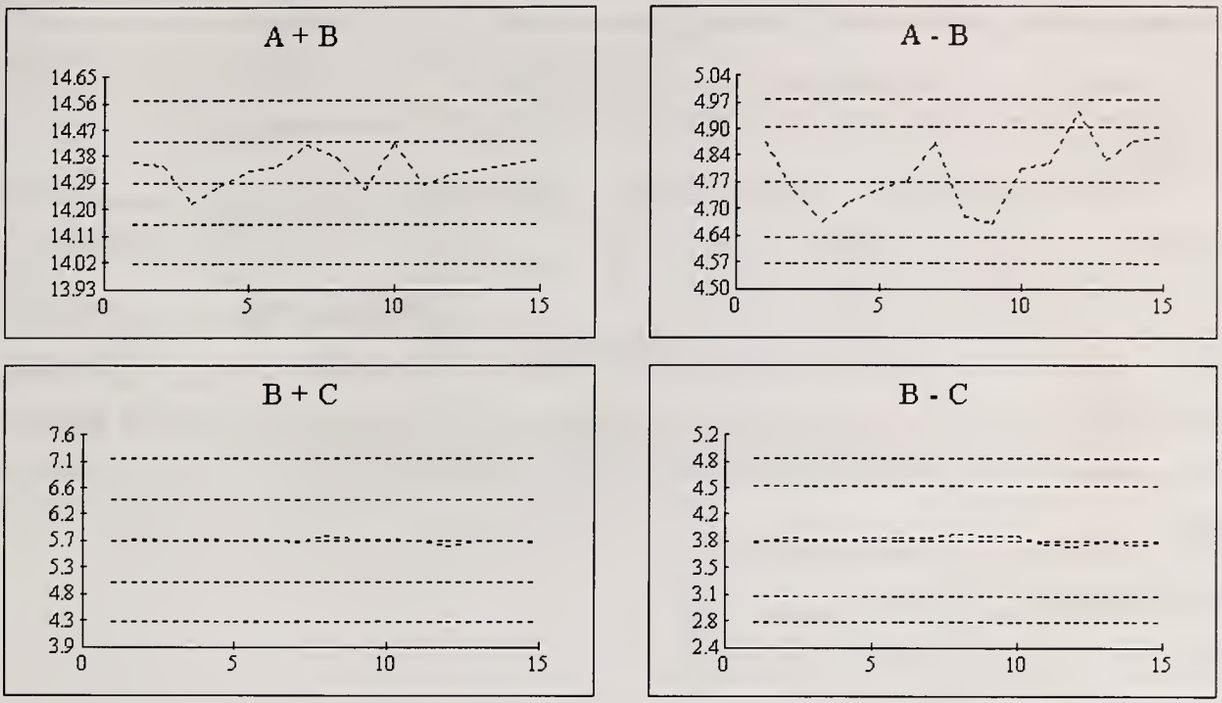
Other Checks

	Number	Mean	Std. Dev.
LTB	15	-0.0062	0.0071

NOTE: History change for full scale from 5 to 12 mg/L on 11/01/2006.

Nitrogen; nitrate+nitrite (E3364)

QC Data; 11/1/2006 to 12/31/2006



NITROGEN, NITRATE PLUS NITRITE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366,TCLPNOT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water and Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative (s)	None

ANALYTICAL PROCEDURE:

Nitrate plus nitrite is determined on the supernatant of a settled sample. Nitrate is reduced to nitrite in alkaline media at 38^{0}C, by hydrazine sulphate with copper as a catalyst. Colourimetry is based on the formation of an azo dye by nitrite, sulphanilamide, and N(1-napthyl) ethylenediamine dihydrochloride. To control metal ion interference, samples are passed through an ion-exchange column prior to the reduction step. Approximate absorbance: 0.7 at the full scale level. Ammonia plus ammonium, nitrite, and reactive phosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: 38^{0}C heating bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 520 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.05	Current T value: 0.25	Full Scale: 50.0 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:

The HP capture / processing system was replaced by "Labtronics" Data Acquisition software in October 1999.
LIMS product code TCLPNOT3366 was added in April 2001.
Surface Water matrix was added in October 2005.

NITROGEN; NITRATE + NITRITE (E3366)

QUALITY CONTROL DATA FROM 01/01/2006 TO 12/31/2006

Analytical Range: to 50.0 mg/L as N

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	34	40	40.122	0.122	0.393
B	34	20	20.229	0.229	0.189
C	34	4	4.040	0.040	0.090
A + B		60	60.352	0.352	0.533
A - B		20	19.893	-0.107	0.311
B + C		24	24.269	0.269	0.247
B - C		16	16.190	0.190	0.165

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.3088
	Within Runs	0.2199
	Between/Within	1.40
s.d.(BC)	Between Runs	0.1483
	Within Runs	0.1167
	Between/Within	1.27

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	59.33	60.67	58.366	61.30
A - B	19.33	20.67	8.99	21.00
B + C	23.64	24.36	23.26	24.70
B - C	15.64	16.36	15.46	16.50

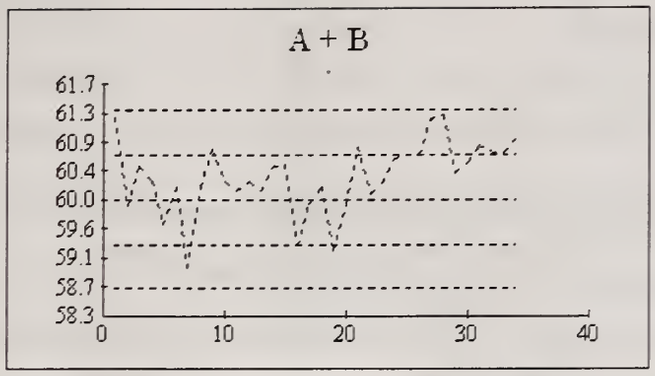
Duplicates:

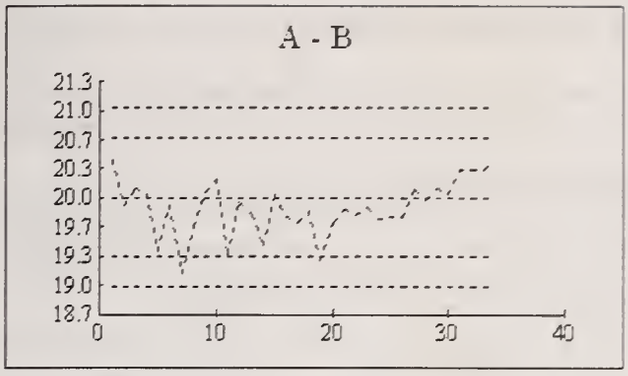
Number	Concentration	Std. Dev.	% Coeff of Var
63	0 - 10%	0.05	4.639
12	10 - 20%	0.067	0.870
11	20 - 50%	0.248	1.678
3	50 - 100%	0.177	0.484
89	Total	0.105	2.160

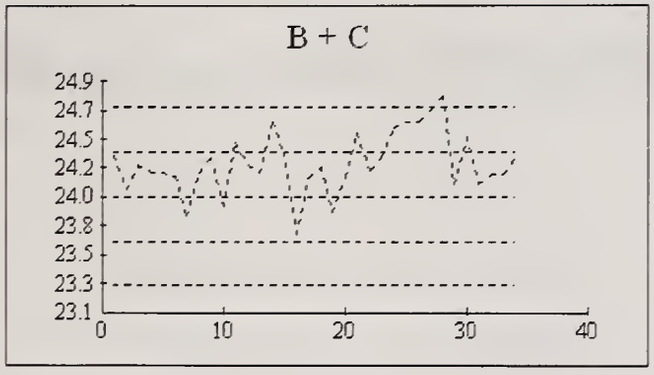
Other Checks	Number	Mean	Std. Dev.
LTB	34	-0.046	0.039

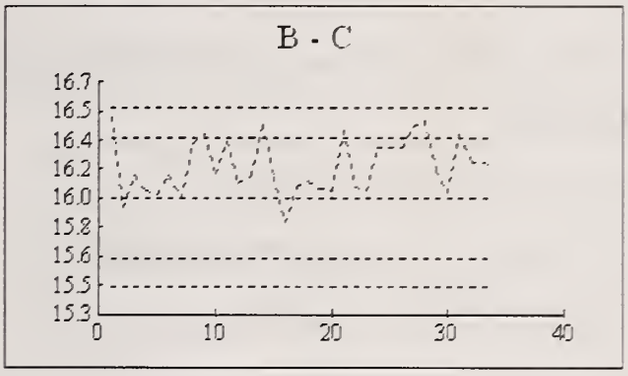
Nitrogen; nitrate+nitrite (E3366)

QC Data; 1/1/2006 to 12/31/2006









NITROGEN, NITRITE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): 1.0 mg/L

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Nitrite is determined on the supernatant of a settled sample by formation of an azo dye using sulphanilami and N(1-napthyl) ethylenediamine dihydrochloride.
Approximate absorbance: 0.6 at the full scale level.
Ammonia plus ammonium, nitrate plus nitrite, and reactive orthophosphate are determined simultaneously

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 520 nm.
Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.001	Current T value: 0.005	Full Scale: 0.200 mg/

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL , standard and BL after every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:

The HP data capture / processing system was replaced by "Labtronics" Data Acquisition software in August 1999.

Nitrogen; nitrite (E3364)
QUALITY CONTRO DATA FROM 01/01/2006 TO 12/31/2006
Analytical Range: to 0.200 mg/L as N

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	63	0.16	0.16	0	0.002
B	63	0.08	0.081	0.001	0.001
C	63	0.016	0.016	0	0.001
A + B		0.24	0.241	0.001	0.003
A - B		0.08	0.079	-0.001	0.001
B + C		0.096	0.097	0.001	0.002
B - C		0.064	0.064	0	0.001

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0016
	Within Runs	0.0007
	Between/Within	2.29
s.d.(BC)	Between Runs	0.001
	Within Runs	0.0007
	Between/Within	1.43

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	0.237	0.243	0.235	0.247
A - B	0.077	0.083	0.076	0.084
B + C	0.094	0.098	0.092	0.100
B - C	0.062	0.066	0.061	0.067

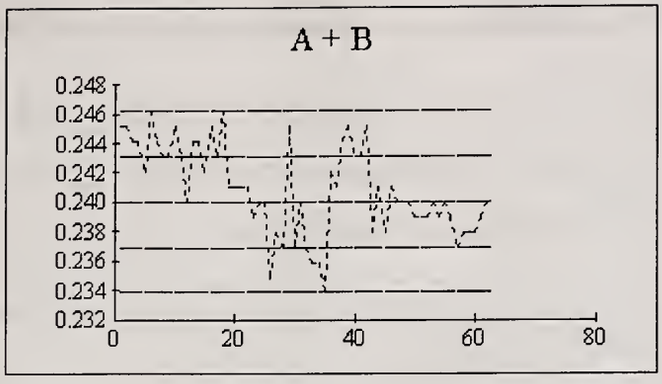
Duplicates:

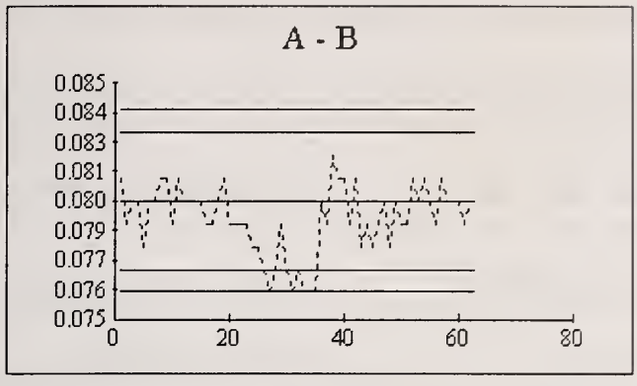
Number	Concentration	Std. Dev.	% Coeff of Var
131	0 - 10%	0.001	37.216
9	10 - 20%	0.001	3.495
1	20 - 50%	N/A	N/A
0	50 - 100%	N/A	N/A
141	Total	0.001	21.076

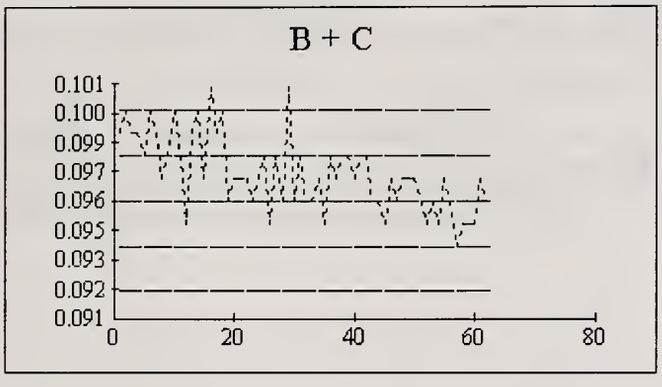
Other Checks	Number	Mean	Std. Dev.
LTB	62	0	0.001

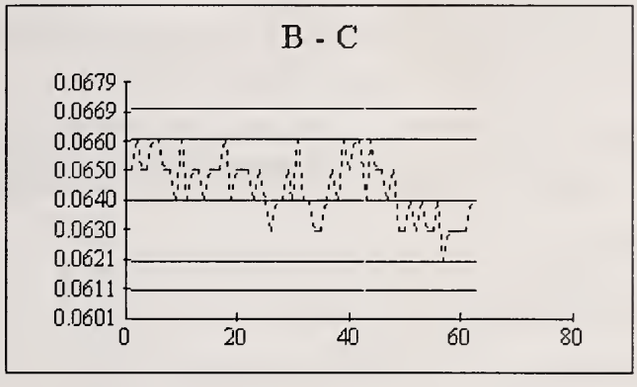
Nitrogen; nitrite (E3364)

QC Data; 1/1/2006 to 12/31/2006









NITROGEN, NITRITE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water) ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water and Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Nitrite is determined on the supernatant of a settled sample by formation of an azo dye using sulphanilamide, and N(1-napthyl) ethylenediamine dihydrochloride.
Approximate absorbance: 0.3 at the full scale level.
Ammonia plus ammonium, nitrate plus nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 520 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.005	Current T value: 0.025	Full Scale: 2.00mg/L

CALIBRATION:

BL plus 7 standards

NITROGEN, NITRITE cont'd

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:

The HP capture / processing system was replaced by "Labtronics" Data Acquisition software in October 1999.
Surface Water Matrix was added in October 2005.

Nitrogen; nitrite (E3366)
QUALITY CONTROL DATA FROM 01/01/2006 TO 12/31/2006
Analytical Range: to 2.00 mg/L as N

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	32	1.60	1.621	0.021	0.010
B	32	0.80	0.810	0.010	0.005
C	32	0.16	0.165	0.005	0.006
A + B		2.40	2.431	0.031	0.012
A - B		0.80	0.812	0.012	0.010
B + C		0.96	0.974	0.014	0.008
B - C		0.64	0.645	0.005	0.007

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0076
	Within Runs	0.0071
	Between/Within	1.07
s.d.(BC)	Between Runs	0.0055
	Within Runs	0.0049
	Between/Within	1.12

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	2.376	2.424	2.353	2.448
A - B	0.776	0.824	0.764	0.836
B + C	0.948	0.972	0.936	0.984
B - C	0.628	0.652	0.622	0.658

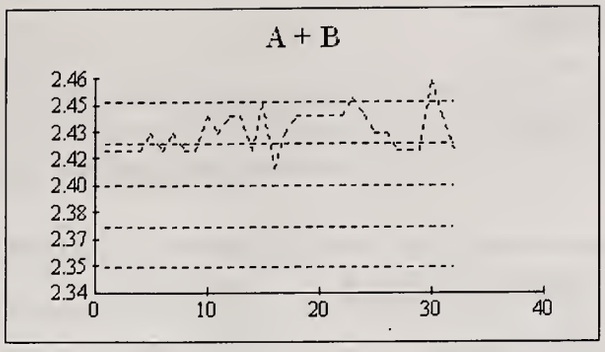
Duplicates:

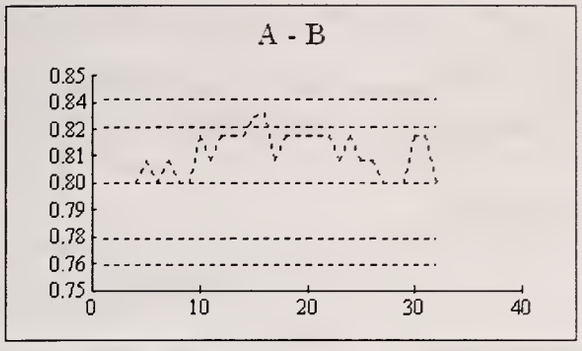
Number	Concentration	Std. Dev.	% Coeff of Var
46	0 - 10%	0.005	7.96
5	10 - 20%	0.004	1.143
4	20 - 50%	0.005	0.877
2	50 - 100%	N/A	N/A
57	Total	0.006	3.321

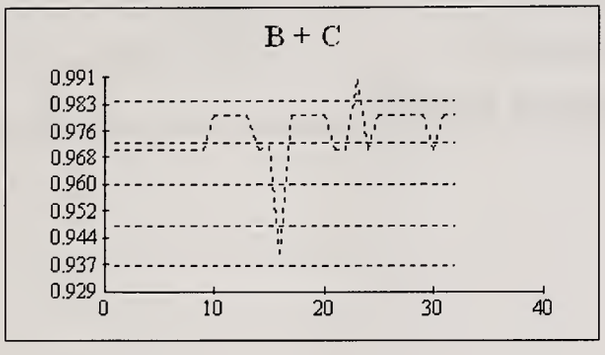
Other Checks	Number	Mean	Std. Dev.
LTB	32	0	0.002

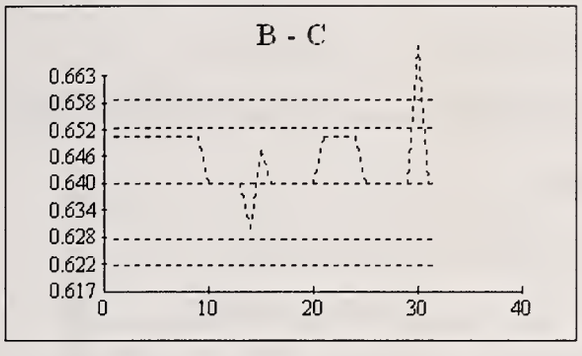
Nitrogen; nitrite (E3366)

QC Data; 1/1/2006 to 12/31/2006









NITROGEN, TOTAL KJELDAHL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes_☑_ No ____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3116	Reporting Unit	mg/g as N
LIMS Product Code	TNP3116	Supervisor	P. Wilson
Sample Type/Matrix	Soil, Sediment, Dried Sludge and Vegetation		

SAMPLING:

Quantity Required	0.08 to 0.4 g
Container	Glass or plastic
Preservative(s)	N/A

ANALYTICAL PROCEDURE:

Nitrogen compounds are converted to ammonia/ammonium by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is filtered and the filtrate is analyzed using an automated colourimetric system.
Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Hot plate .
Basic automated modular continuous flow system: 37.5°C bath. Colourimetric measurement is through a 5 cm. light path at 630 nm.
Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.1	Current T value: 0.5	Full Scale: 10 mg/L

CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Drift	Run 80% calibration standard every 10 samples
Recovery	3 digested BL's plus 4 digested standards R1, R2, R3 and R4

NOTES:
System is calibrated with undigested standards. QCA, QCB and QCC were implemented in April 2003. February 2004, Method E3118 was amalgamated with E3116. Data capture/processing is done by the "Labtronics" Data Aquisition software.

NITROGEN; TOTAL KJELDAHL (E3116)

Analytical Range: to 10 mg/L as N

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	18	8	8.0450	0.0450	0.041
B	18	4	3.9667	-0.0333	0.025
C	18	1	0.9800	-0.0200	0.014
A + B	18	12	12.0117	0.0117	0.055
A - B	18	4	4.0783	0.0783	0.041
B + C	18	5	4.9467	-0.0533	0.033
B - C	18	3	2.9867	-0.0133	0.023

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0315
	Within Runs	0.0287
	Between/Within	1.19
s.d.(BC)	Between Runs	0.0203
	Within Runs	0.0165
	Between/Within	1.23

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	12.11	11.89	12.22	11.78
A - B	4.11	3.89	4.16	3.84
B + C	5.08	4.92	5.16	4.84
B - C	3.08	2.92	3.12	2.88

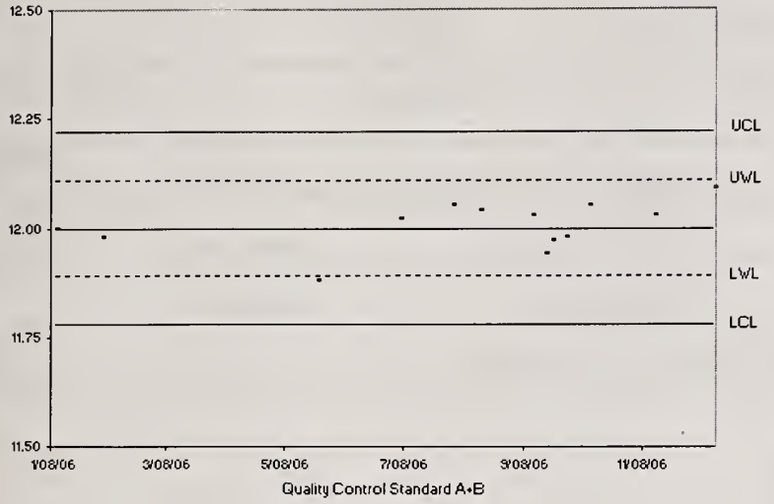
Duplicates:

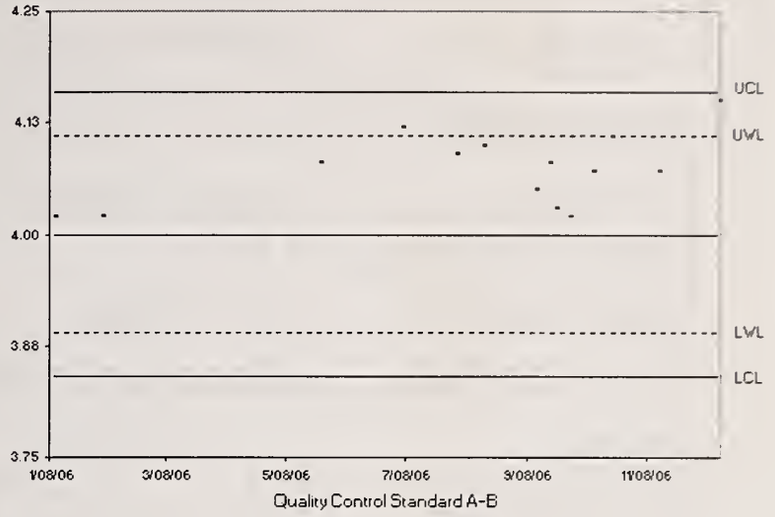
Number	Concentration	Std. Dev.	% Coeff of Var
37	0.0 - 10.0	0.1512	6.9
5	10.1 - 20.0	0.5526	3.3
12	20.1 - 50.0	2.0318	7.4
0	50.1 - 100	N/A	N/A
	Total	2.1285	0.011

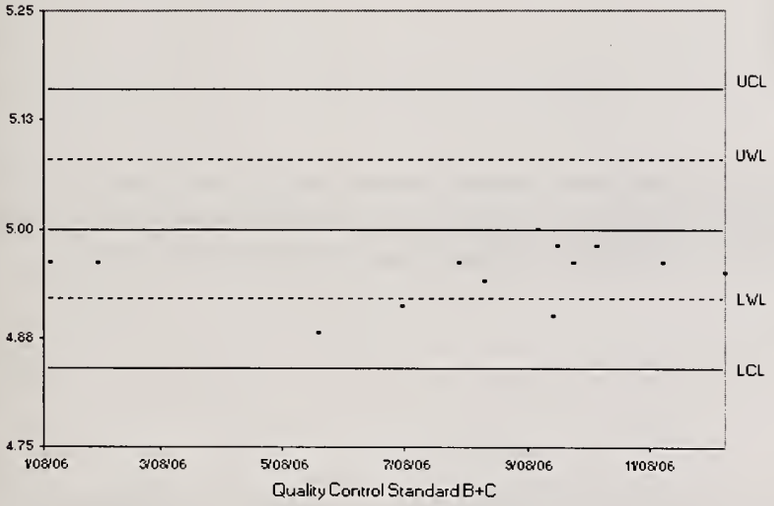
Recoveries:	Number	Expected	Mean	Mean Bias	Std. Dev. (1)
R1	18	5.25	5.294	0.044	0.172
RS-92	18	1.69	1.416	-0.274	0.026
RSM-2781	18	42.2	39.625	-2.575	1.801
Pine Needles	5	12.0	11.569	-0.431	0.405

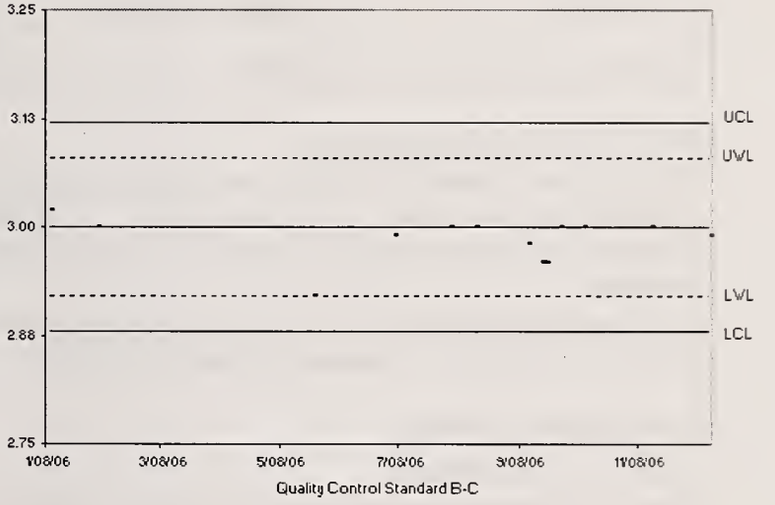
Other Checks	Number	Mean	Std. Dev.
LTB	15	0.1067	0.2740
Digested Blanks	14	0.0798	0.0433

NITROGEN; total Kjeldahl (E3116)
QUALITY CONTROL DATA FROM 01/05/2006 TO 12/15/2006
Analytical Range: to 10 mg/g as N









NITROGEN, TOTAL KJELDAHL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3367	Reporting Unit	mg/L as N
LIMS Product Code	TOTNUT3367	Supervisor	P.Wilson
Sample Type/Matrix	Precipitation, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line in two stages and then ammonia is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst.
Approximate absorbance: 0.3 at the full scale level.
Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Three block digesters
Basic automated modular continuous flow system plus 1 module: 38°C bath (7.7 mL delay). Colourimetric measurement is through a 5.0 cm. light path at 630 nm.
Data capture and processing is via a computer system

REPORTING:

Max. Significant Figures: 3	Current W value: 0.02	Current T value: 0.10	Full Scale: 2.0mg/L

CALIBRATION:

BL plus 7 undigested standards

NITROGEN, TOTAL KJELDAHL cont'd

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL, undigested standard , BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

The HP capture / processing system was replaced by "Labtronics" Data Acquisition software in May 1999.

NITROGEN; TOTAL KJELDAHL (E3367)

QUALITY CONTROL FROM 01/01/2006 TO 12/31/2006

Analytical Range: to 2.0 mg/L as N

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	57	1.6	1.6126	0.0126	0.0175
B	57	0.8	0.8054	0.0054	0.0113
C	57	0.16	0.1633	0.0033	0.0099
A + B		2.4	2.4181	0.0181	0.0239
A - B		0.8	0.8072	0.0072	0.0172
B + C		0.96	0.9688	0.0088	0.0194
B - C		0.64	0.6421	0.0021	0.0088

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0147
	Within Runs	0.0122
	Between/Within	1.20
s.d.(BC)	Between Runs	0.0106
	Within Runs	0.0062
	Between/Within	1.71

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	2.376	2.44	2.32	2.48
A - B	0.760	0.840	0.740	0.860
B + C	0.936	0.984	0.913	1.007
B - C	0.617	0.663	0.605	0.675

Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
47	0 - 10%	0.01	7.6
64	10 - 20%	0.032	10.6
46	20 - 50%	0.031	6
1	50 - 100%	N/A	N/A
158	Total	0.027	8.5

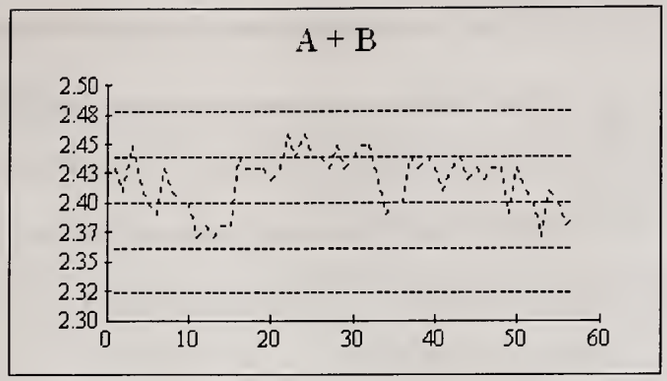
Recoveries

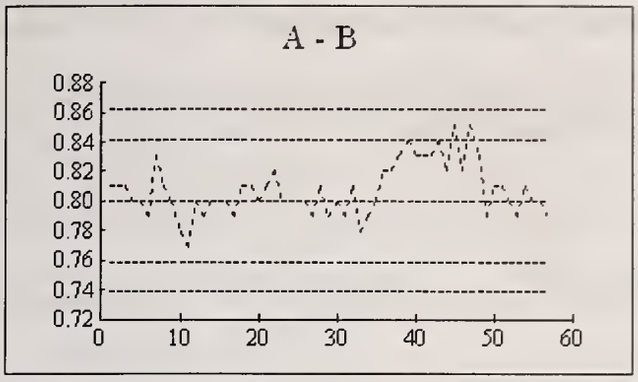
Number	Expected	Mean	Std. Dev.
57	1.4	1.341	0.237
57	0.84	0.814	0.113
57	0.28	0.291	0.155

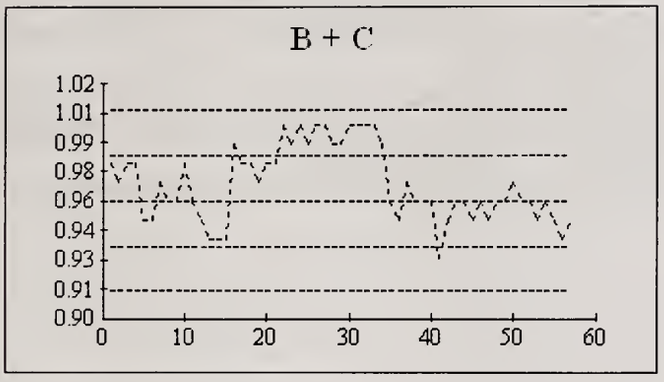
Other Checks	Number	Mean	Std. Dev.
LTB	57	0.0065	0.0129
Digested Blank	57	0.0188	0.0167

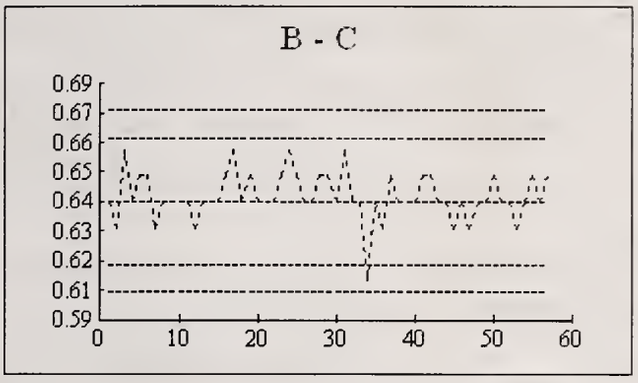
`Nitrogen;total Kjeldahl (E3367)

QC Data; 1/1/2006 to 12/31/2006









NITROGEN, TOTAL KJELDAHL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3368	Reporting Unit	mg/L as N
LIMS Product Code	TOTNUT3368	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Raw Sewage, Industrial Waste, Effluent, Ground Water, Process Water, Leachate, Precipitation and Surface Water.		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line in two stages and then ammonia is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst.
Approximate absorbance: 1.0 at the full scale level.
Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Three block digesters
Basic automated modular continuous flow system plus 1 module: 38°C bath (7.7 mL delay).
Colourimetric measurement is through a 1.5 cm. light path at 630 nm.
Data capture and processing is via a computer system

REPORTING:

Max. Significant Figures: 3	Current W value: 0.05	Current T value: 0.25	Full Scale: 50.0 mg/L

CALIBRATION:

BL plus 7 undigested standards

NITROGEN, TOTAL KJELDAHL cont'd

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL, undigested standard, BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

System is calibrated with undigested standards.
The HP capture / processing system was replaced by "Labtronics" Data Acquisition software in April 1999.
Precipitation and Surface Water were added in October 2005.

NITROGEN; total Kjeldahl (E3368)

Analytical Range: to 50.0 mg/L as N

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	33	40	39.9745	-0.0255	0.2144
B	33	20	20.0452	0.0452	0.1440
C	33	4	3.9694	-0.0306	0.0425
A + B		60	60.0197	0.0197	0.3367
A - B		20	19.9294	-0.0706	0.1416
B + C		24	24.0145	0.0145	0.1573
B - C		16	16.0758	0.0758	0.1426

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.1826
	Within Runs	0.1001
	Between/Within	1.82
s.d.(BC)	Between Runs	0.1062
	Within Runs	0.1008
	Between/Within	1.05

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	59.64	60.36	59.27	60.73
A - B	19.64	20.36	19.45	20.55
B + C	23.79	24.21	23.58	24.42
B - C	15.79	16.21	15.68	16.32

Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
76	0 - 10%	0.25	30.7
9	10 - 20%	0.371	5.4
3	20 - 50%	0.104	0.6
2	50 - 100%	N/A	N/A
90	Total	0.279	10.3

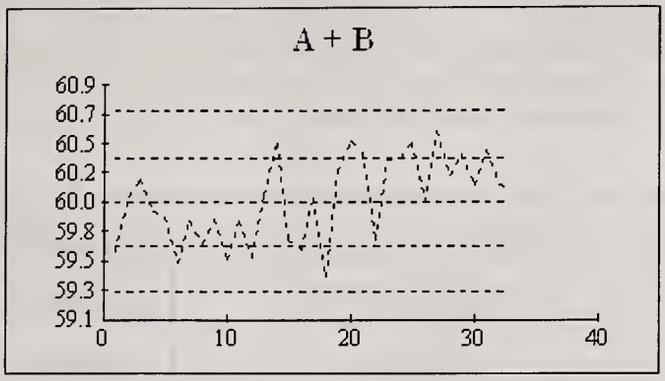
Recoveries

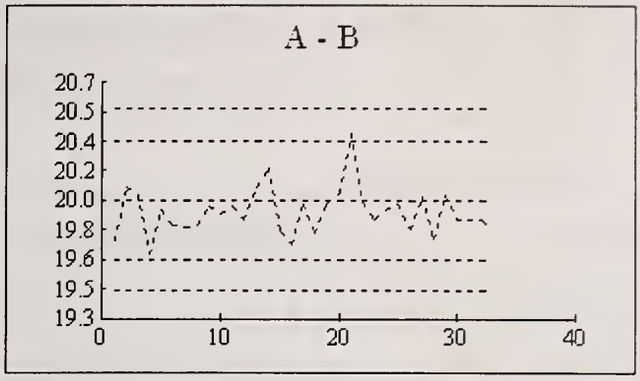
Number	Expected	Mean	Std. Dev.
32	35	35.082	0.932
32	21	21.203	0.489
32	7	7.065	0.183

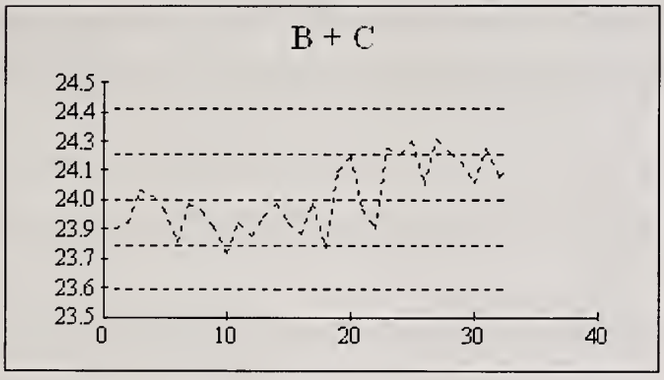
Other Checks	Number	Mean	Std. Dev.
LTB	33	-0.0688	0.0524
Digested Blank	33	-0.0706	0.0485

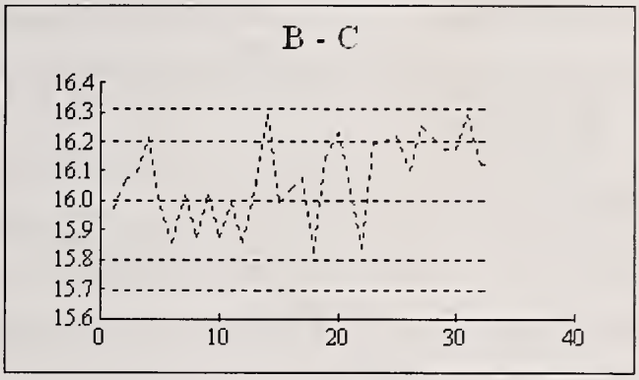
Nitrogen; total Kjeldahl (E3368)

QC Data; 1/1/2006 to 12/31/2006









OXYGEN DEMAND, BIOCHEMICAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3182	Reporting Unit	mg/L as O_2
LIMS Product Code	BOD3182, BODC3182	Supervisor	P. Wilson
Sample Type/Matrix	Raw Sewage, Industrial Waste, Effluent, Ground Water, Leachate, Surface Water		

SAMPLING:

Quantity Required:	400 mL
Container:	Glass or plastic
Preservative(s)	None

SAMPLE PREPARATION:

If necessary sample pH is adjusted to neutral and chlorine is removed by reaction with sodium sulphite.

ANALYTICAL PROCEDURE:

Oxygen depletion is measured as the difference in dissolved oxygen (DO) concentration. DO readings are taken prior to sample storage, and also at the end of storage in the dark at 20^0C for five days (BOD5). If necessary, dilutions are made with aerated, nutrient-enriched water to obtain a 25-75% oxygen depletion. If the sample has undergone any of the sample preparation steps listed above or if the sample is an industrial waste, a sewage seed is added. For such samples, calculation of an appropriate seed correction is required.

INSTRUMENTATION:

-YSI Model 59 DO meter (Yellow Springs Instrument Company) with DO probe equipped with stirrer and fitted with a Teflon membrane of 0.5 mil thickness which is permeable to oxygen (1 mil = 0.001 inch).
-Titration equipment for Winkler analysis of dissolved oxygen.
-Incubator (19-21°C); BOD bottles (300 mL)

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 9.0 mg/L

CALIBRATION (DO):

The standard is air-saturated reverse osmosis deionized water. The DO content is read from a table (ORBISPHERE LABORATORIES - Pressure/temperature/dissolved oxygen table) after measuring the temperature and the barometric pressure in the laboratory.

CONTROLS:

Calibration (DO)	2 QC solutions of Pure-DW water which have been partially stripped of DO by flushing with nitrogen. These "solutions", of different but unknown DO, are compared using the oxygen meter and the Winkler titration procedure. The difference between the values for the two analytical methods is utilized as a slope control for the DO Analyzer.
Recovery (BOD5)*	3 Recovery standards prepared from a combination of Glucose and Glutamic Acid e.g. R1; the expected BOD5 is 67% of the oxygen requirement for complete oxidation.
Drift	Air saturated Pure-DW water after every 24 samples.
Blanks*	Pure-DW water and BOD dilution water

NOTES:

* These solutions are incubated for five days alongside samples.

OXYGEN DEMAND, BIOCHEMICAL (E3182)

QUALITY CONTROL DATA FROM 01/06/06 TO 12/30/06

Analytical Range: to 9.0 mg/L as O2 at 20°C

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	82	0.00	0.0348	0.0348	0.08
B	82	0.00	0.0213	0.0213	0.0585

On any given day the calibration is accepted if the value obtained lie within the ranges:

-0.25 - 0.25

Recoveries:

Number of Data	Expected Depletion	Mean Depletion	Std. Dev.
41	2.17	2.03	0.139
41	4.34	4.12	0.2598
41	6.54	6.28	0.3816

Duplicates:

for BOD:

Number	Concentration	Std. Dev.	% Coeff of Var
10	0.0 - 1.8	0.1144	14.56
4	1.9 - 4.5	0.1176	3.8
5	4.6 - 9.0	0.0751	0.94
19	Total	0.1062	3.34

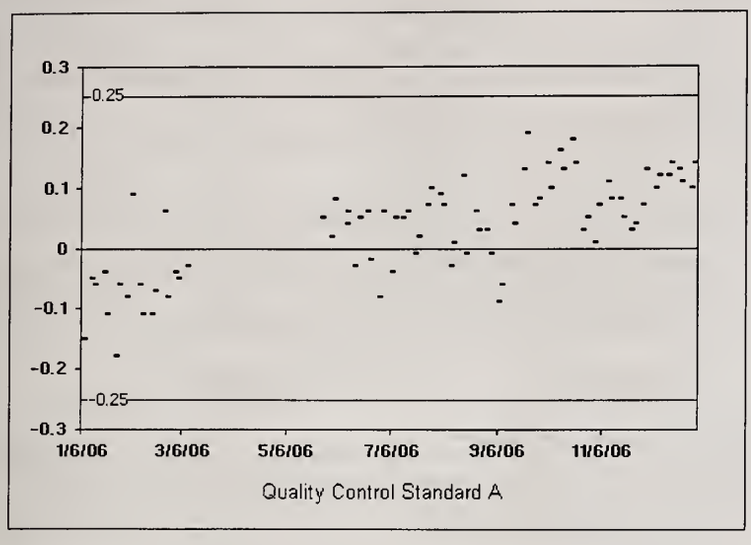
for BODC:

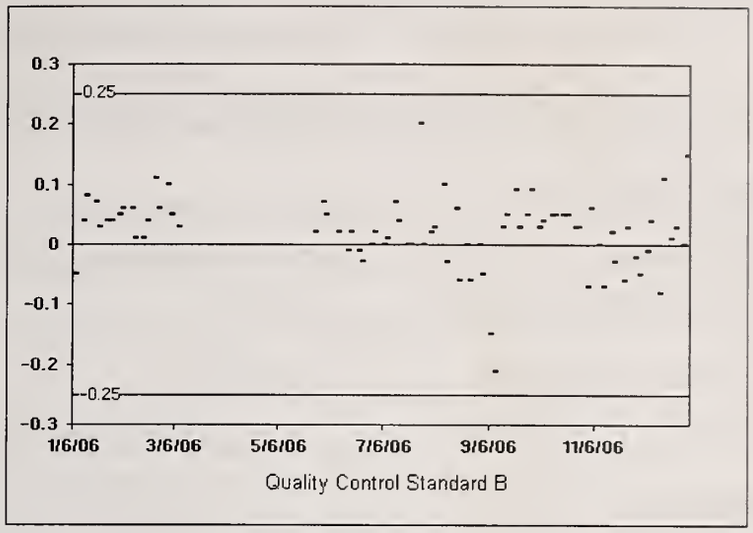
Number	Concentration	Std. Dev.	% Coeff of Var
45	0.0 - 1.8	0.1381	14.67
32	1.9 - 4.5	0.1259	4.79
19	4.6 - 9.0	0.1403	2.1
96	Total	0.1346	5.09

OXYGEN DEMAND, BIOCHEMICAL (E3182)

QUALITY CONTROL DATA FROM 01/06/06 TO 12/30/06

Analytical Range: to 9.0 mg/L as O_2 at 20°C





OXYGEN DEMAND, CHEMICAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/07/82
Method Reference No.	E3170	Reporting Unit	mg/L as O_2
LIMS Product Code	COD3170	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are mixed with an acidified potassium dichromate solution which contains mercuric sulphate to suppress chloride interference. After adding concentrated sulphuric acid containing silver sulphate as a catalyst, the mixture is digested in a mechanical-convection oven for 3 hours at 149°C. Analysis is completed by automated colourimetric measurement of trivalent chromium. Approximate absorbance: 0.05 at the full scale level.

INSTRUMENTATION:

-Culture tubes with Teflon caps, mechanical-convection oven
-Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Max. Significant Figures: 3	Current W value: 1	Current T value: 5	Full Scale: 50mg/L

CALIBRATION:

3 digested BL plus 3 digested standards

OXYGEN DEMAND, CHEMICAL cont'd

CONTROLS:

Calibration	2 digested standards, e.g. QCA
Drift	Digested BL, standard in run QCA, in run QCB, and digested BL every 10 samples
Recovery	2 digested standards, e.g. R1
Interference	Digested standard (40 mg/L as O_2) spiked with 50 mg/L Cl confirms suppression of chloride interference.

NOTES:

In order to retard sample decomposition the first reagent (acidified dichromate) is added as soon as possible at the laboratory. Analysis is scheduled for completion within the week.

The recovery standard is a material known to be very difficult to digest. The expected recovery is approximately 85%, based on long term experience. We continue to use this material in spite of the poor recovery, because if the slightest problem exists with the digestion step, the recovery falls off sharply to approximately 10%.

Oxygen Demand, Chemical (E 3170)
QUALITY CONTROL DATA FROM 01/01/2006 TO 12/31/2006
Analytical Range: to 50 mg/L as O_2

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	11	40	40.381	0.381	1.077
B	11	10	9.543	-0.457	0.877
A + B		50	49.924	-0.076	1.776
A - B		30	30.838	0.838	0.84

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.9821
	Within Runs	0.594
	Between/Within	1.65

Control Limits:

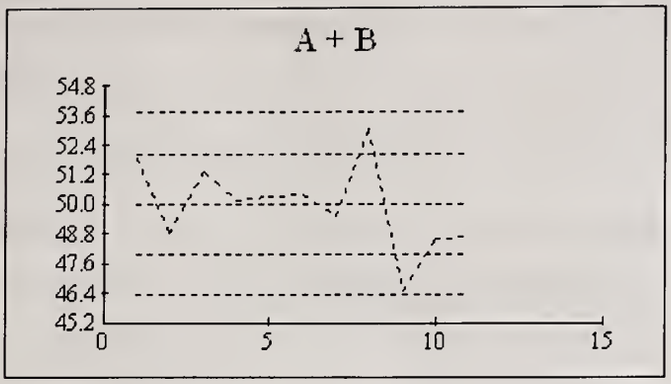
Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	48.0	52.0	46.3	53.7
A - B	28.0	32.0	27.2	32.8

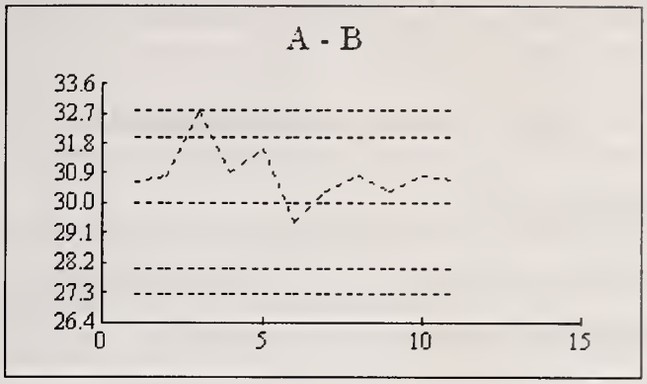
Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
3	0 - 10%	0.297	7.139
1	10 - 20%	N/A	N/A
12	20 - 50%	0.973	5.212
6	50 - 100%	2.684	8.519
23	Total	1.549	7.377

Oxygen Demand Chemical (E3170)

QC Data; 1/1/2006 to 12/31/2006





OXYGEN DEMAND, CHEMICAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status	Licensed (Drinking Water): N/A
Yes _☑_ No_____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/07/82
Method Reference No.	E3246	Reporting Unit	mg/L as O_2
LIMS Product Code	COD3246	Supervisor	P. Wilson
Sample Type/Matrix	Raw Sewage, Industrial Waste, Ground Water, Leachate, Effluent, Sludge, Surface Water, Process Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are mixed with an acidified potassium dichromate solution which contains mercuric sulphate to suppress chloride interference. After adding concentrated sulphuric acid containing silver sulphate as a catalyst, the mixture is digested in a mechanical-convection oven for 3 hours at 149°C. Analysis is completed by automated colourimetric measurement of trivalent chromium. Approximate absorbance: 0.6 at the full scale level.

INSTRUMENTATION:

-Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Max. Significant Figures: 3	Current W value: 2	Current T value: 10	Full Scale: to 500 mg/L

CALIBRATION:

2 digested BL plus 4 digested standards

CONTROLS:

Calibration	2 digested standards, e.g. QCA
Drift	Digested BL, Standard in run QCA, in run QCB, and Digested BL every 10 samples
Recovery	2 digested standards, e.g. R1
Interference	Digested standard (50 mg/L as O_2) spiked with 900 mg/L Cl confirms suppression of chloride interference.

NOTES:

In order to retard sample decomposition the first reagent (acidified dichromate) is added as soon as possible at the laboratory. Analysis is scheduled for completion within the week.

The recovery standard is a material known to be very difficult to digest. The expected recovery is approximately 85%, based on long term experience. We continue to use this material in spite of the poor recovery, because if the slightest problem exists with the digestion step, the recovery falls off sharply to approximately 10%.

OXYGEN DEMAND CHEMICAL(E3246)
Analytical Range: to 500 mg/L as O_2

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	39	400	398.408	-1.592	5.668
B	39	100	99.275	-0.725	4.684
A + B		500	497.683	-2.317	7.246
A - B		300	299.133	-0.867	7.459

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	5.1997
	Within Runs	5.2743
	Between/Within	0.99

Control Limits:

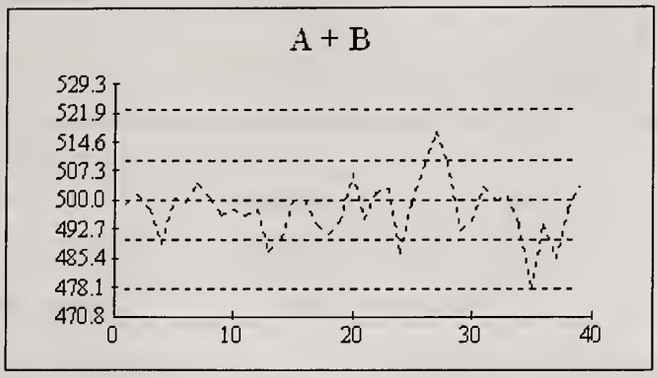
Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	490	510	477.5	522.5
A - B	290	310	285	315

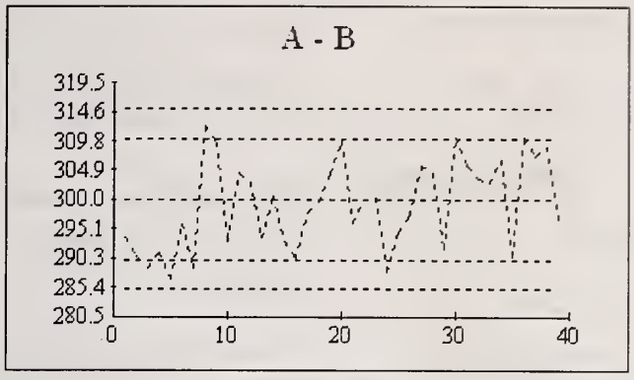
Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
40	0 - 10%	1.642	7.257
30	10 - 20%	2.852	4.94
24	20 - 50%	3.037	2.573
12	50 - 100%	7.347	2.594
110	Total	4.223	4.348

Oxygen Demand Chemical (E3246)

QC Data; 1/1/2006 to 12/31/2006





pH

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes_☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	09/07/80
Method Reference No	E3218	Reporting Units	Dimensionless
LIMS Product Code	PHALCO3218, CONDPH3218	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

pH is directly measured on a stirred sample (30.0 mL) at room temperature. Stirring rate, tube size, degree of electrode immersion, and room temperature range are uniform for all samples and standards.
Total fixed endpoint alkalinity, and conductivity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with computer control and data processing software.

REPORTING:

Max. Significant Figures: 3	Full Scale: 14.00 dimensionless

CALIBRATION:

2 standard buffers covering the pH range of 4 to 9

CONTROLS:

Calibration	2 QC standards e.g. QCA
Drift	In-run standards throughout the run (diluted tap water 50% V/V)

pH, (E 3218)

QUALITY CONTROL DATA FROM 01/06/06 TO 12/21/06

Analytical Range: to 14.00 Dimensionless

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.(1)
A	95	7.41	7.41	0	0.1520
B	95	4.45	4.47	0.02	0.0268
A + B	95	11.86	11.89	0.03	0.0304
A - B	95	2.96	2.94	-0.02	0.0311

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.015
	Within Runs	0.0156
	Between/Within	0.99

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	11.75	11.97	11.86	12.08
A - B	2.85	3.07	2.79	3.13

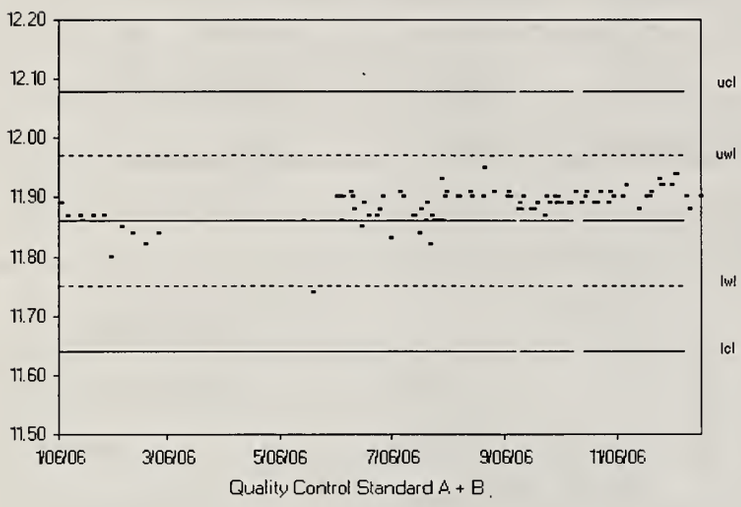
Duplicates:

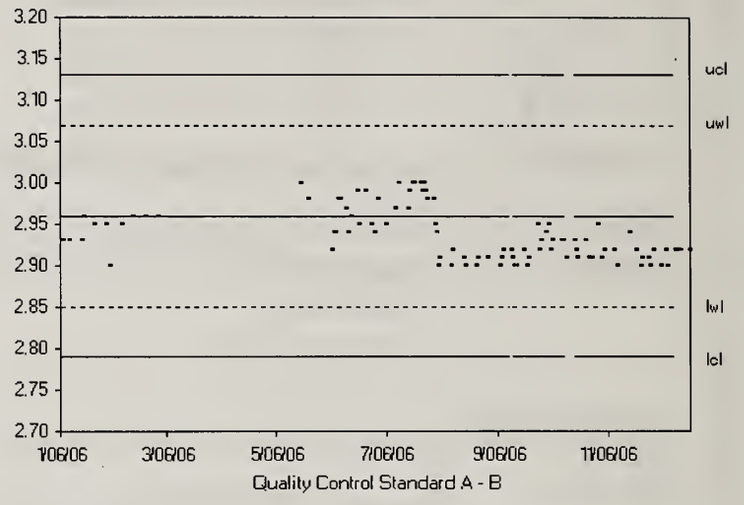
Number	Concentration	Std. Dev. (2)	% Coeff of Var
23	1.00 - 7.00	0.1041	1.7147
125	7.01 - 8.00	0.0212	0.2779
131	8.01 - 12.00	0.5350	0.6439
279	Total	0.0950	1.2106

pH

QUALITY CONTROL DATA FROM 01/06/06 TO 12/21/06

Analytical Range: to 14.00 Dimensionless





PHENOLICS, REACTIVE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/74
Method Reference No.	E3179	Reporting Unit	µg/L as Phenol
LIMS Product Code	PHEN3179	Supervisor	P.Wilson
Sample Type/Matrix	Ground Water, Surface Water, Effluent, Drinking Water, Leachate, Raw Sewage, Industrial Waste, Process Water, Precipitation		

SAMPLING:

Quantity Required	250 mL
Container	Glass, (Phenol bottle with white cap containing preservative is available)
Preservative	Sulphuric acid to pH 1.5 - 2

ANALYTICAL PROCEDURE:

Samples are automatically distilled from an acid media, and reactive phenolics in the distillate are determined colourimetrically by formation of an antipyrene dye through reactions with 4-aminoantipyrene and potassium ferricyanide.
Approximate absorbance: 0.03 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system plus a distillation module. Colourimetric measurement is through a 5.0 cm. light path at 505 nm. Data capture and processing via a Data Acquisition System.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.2	Current T value: 1.0	Full Scale: 50 µg/L

CALIBRATION:

BL plus 2 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA (see note)
Drift	BL ,standard ,BL every 10 samples

PHENOLICS, REACTIVE cont'd

NOTES:

An additional Quality Control Standard (QCC) was added to the method in March 1997.
The HP data capture / processing system was replaced by "Labtronics" Data Acquisition software in August 2002.

PHENOLICS; 4-AAP (E3179)
QUALITY CONTROL DATA FROM 01/01/2006 TO 12/31/2006
Analytical Range; to 50µg/L as Phenol

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	25	40	39.96	-0.04	0.428
B	25	10	10.12	0.12	0.283
C	25	5	5.08	0.08	0.171
A + B		50	50.08	0.08	0.620
A - B		30	29.84	-0.16	0.376
B + C		15	15.20	0.20	0.372
B - C		5	5.040	0.04	0.283

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.3629
	Within Runs	0.2659
	Between/Within	1.36
s.d.(BC)	Between Runs	0.2336
	Within Runs	0.2001
	Between/Within	1.17

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	49.035	50.965	48.07	51.93
A - B	29.035	30.965	28.552	31.448
B + C	14.536	15.464	13.072	16.928
B - C	4.536	5.464	4.304	5.696

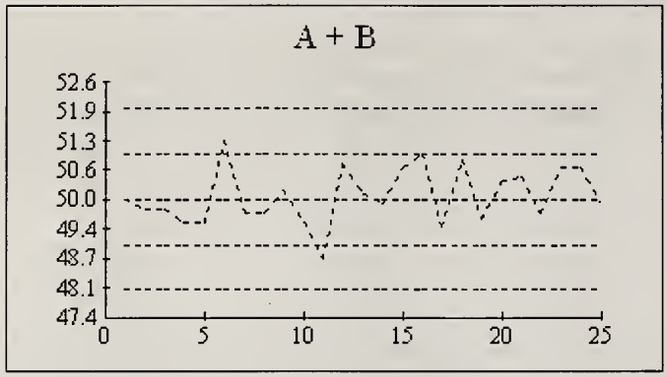
Duplicates:

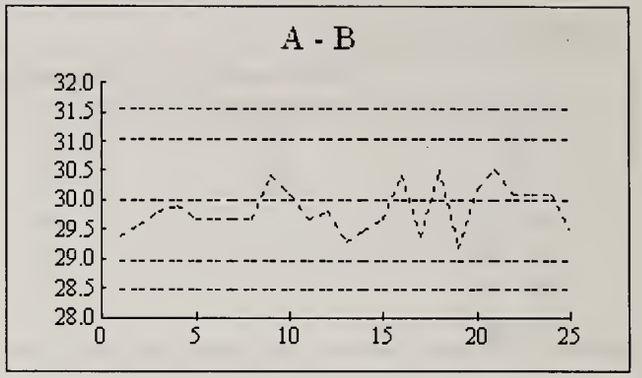
Number	Concentration	Std. Dev.	% Coeff of Var
44	0 - 10%	0.133	21.226
5	10 - 20%	0.178	2.119
2	20 - 50%	0.105	0.575
2	50 - 100%	0.2	0.499
55	Total	0.167	2.525

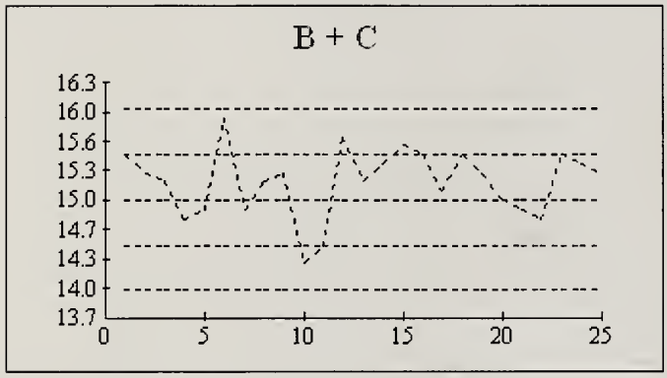
Other Checks	Number	Mean	Std. Dev.
LTB	25	0.024	0.201

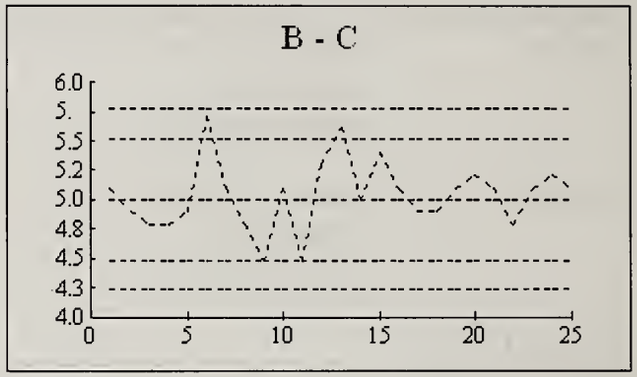
Phenolics; 4-AAP (E3179)

QC Data; 1/1/2006 to 12/31/2006









PHOSPHOROUS, REACTIVE ortho-PHOSPHATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3364	Reporting Unit	mg/L as P
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Ortho-phosphate is determined on the supernatant of a settled sample by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.
Approximate absorbance: 0.2 at the full scale level.
Ammonia plus ammonium, nitrite, and nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using IR sensitive phototube.
Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.0005	Current T value: 0.0025	Full Scale: 0.100 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL after every 10 samples

PHOSPHOROUS, REACTIVE ortho-PHOSPHATE

NOTES:

The HP data capture / processing system was replaced by “Labtronics” Data Acquisition software in August 1999.

PHOSPHORUS; PHOSPHATE (E3364)
Analytical Range: to 0.100 mg/L as P

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	64	0.08	0.079	-0.001	0.001
B	64	0.04	0.041	0.001	0.0011
C	64	0.008	0.008	0	0.0005
A + B		0.12	0.12	0	0.0017
A - B		0.04	0.038	-0.002	0.0011
B + C		0.048	0.049	0.001	0.0014
B - C		0.032	0.033	0.001	0.0009

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.001
	Within Runs	0.0008
	Between/Within	1.25
s.d.(BC)	Between Runs	0.0008
	Within Runs	0.0006
	Between/Within	1.33

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	0.1176	0.1224	0.1152	0.1248
A - B	0.0376	0.0424	0.0364	0.0436
B + C	0.0464	0.0496	0.0448	0.0512
B - C	0.0302	0.0332	0.0296	0.0344

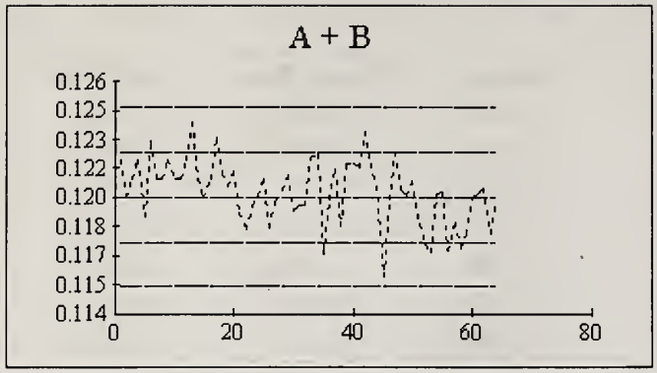
Duplicates:

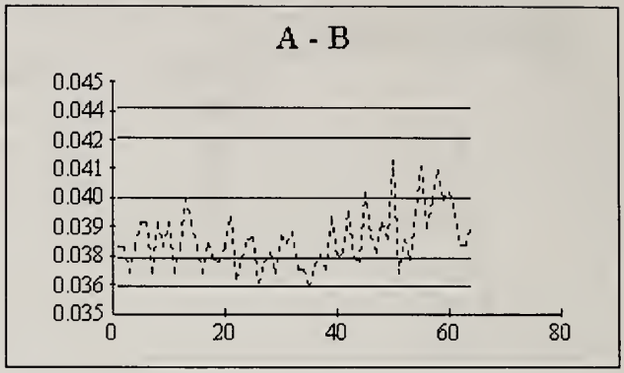
Number	Concentration	Std. Dev.	% Coeff of Var
143	0 - 10%	0.001	44.807
12	10 - 20%	0.002	14.197
9	20 - 50%	0.004	13.269
4	50 - 100%	0.003	4.496
168	Total	0.001	16.368

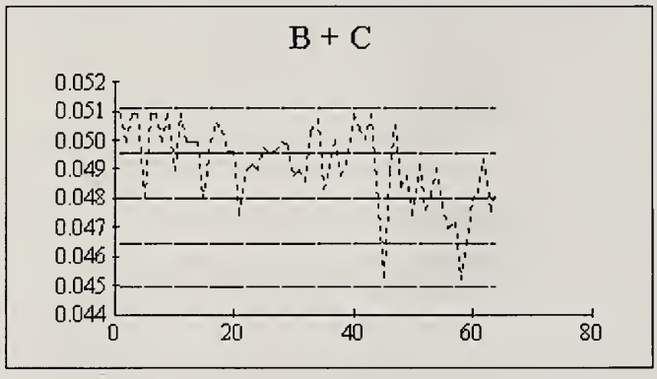
Other Checks	Number	Mean	Std. Dev.
LTB	62	0.0002	0.0008

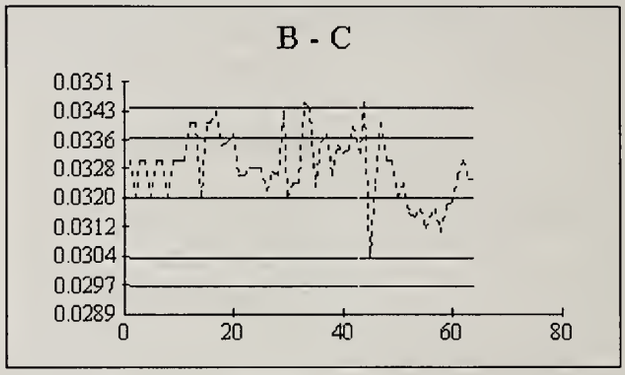
Phosphorus; phosphate (E3364)

QC Data; 1/1/2006 to 12/31/2006









PHOSPHORUS, REACTIVE ortho-PHOSPHATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3366	Reporting Unit	mg/L as P
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water, Surface Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Ortho-phosphate is determined on the supernatant of a settled sample by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.
Approximate absorbance: 0.5 at the full scale level.
Ammonia plus ammonium, nitrite, and nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using IR sensitive phototube.
Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.02	Current T value: 0.10	Full Scale: 10 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples

NOTES:

The HP capture / processing system was replaced by "Labtronics" Data Acquisition software in October 1999.

Surface Water was added in October 2005.

PHOSPHORUS; PHOSPHATE (E3366)

Analytical Range: to 10.0 mg/L as P

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	33	8	8.048	0.048	0.086
B	33	4	4.03	0.030	0.041
C	33	0.8	0.817	0.017	0.021
A + B		12	12.078	0.078	0.099
A - B		4	4.018	0.018	0.09
B + C		4.8	4.848	0.048	0.052
B - C		3.2	3.213	0.013	0.04

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0671
	Within Runs	0.0636
	Between/Within	1.06
s.d.(BC)	Between Runs	0.0325
	Within Runs	0.0283
	Between/Within	1.15

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	11.857	12.143	11.713	12.287
A - B	3.857	4.143	3.785	4.215
B + C	4.719	4.881	4.638	4.962
B - C	3.119	3.281	3.079	3.321

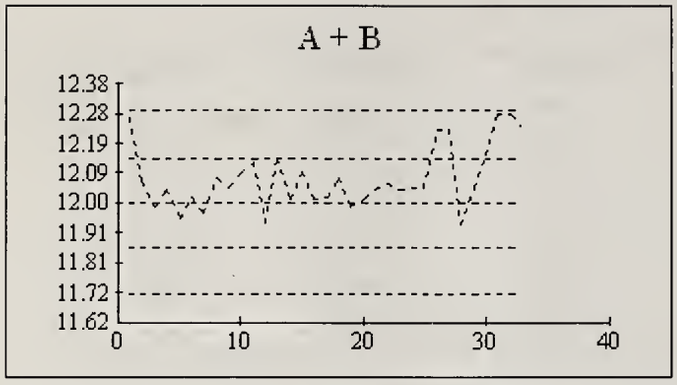
Duplicates:

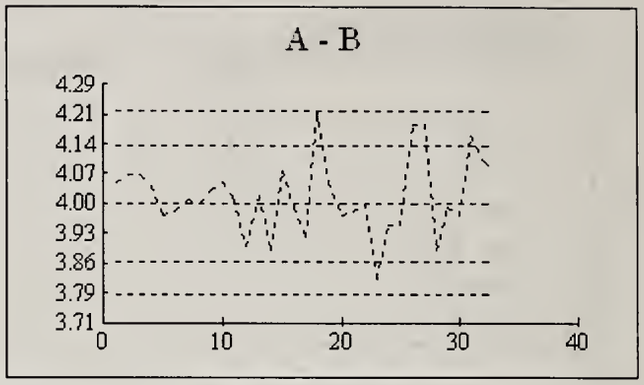
Number	Concentration	Std. Dev.	% Coeff of Var
74	0 - 10%	0.04	175.616
4	10 - 20%	0.319	29.3
0	20 - 50%	N/A	N/A
2	50 - 100%	N/A	N/A
80	Total	0.082	33.214

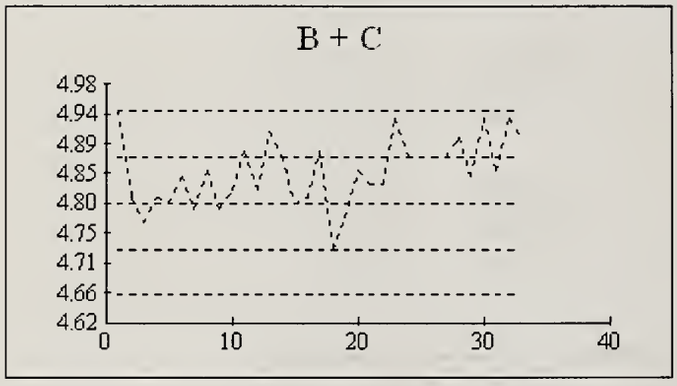
Other Checks	Number	Mean	Std. Dev.
LTB	33	-0.049	0.026

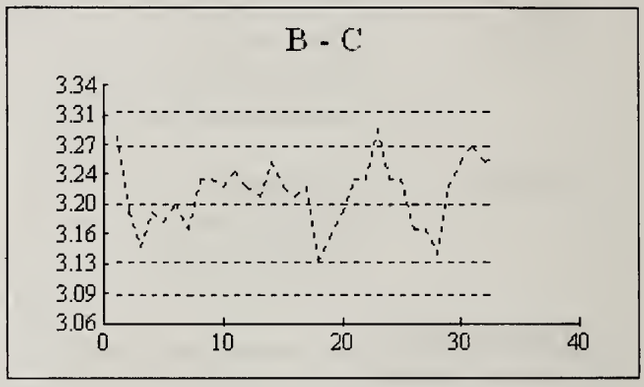
Phosphorus; phosphate (E3366)

QC Data; 1/1/2006 to 12/31/2006









PHOSPHORUS, TOTAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status: Yes _☑_ No _____	Licensed (Drinking Water): N/A
	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3116	Reporting Unit	mg/g as P
LIMS Product Code	TNP3116	Supervisor	P. Wilson
Sample Type/Matrix	Soil, Sediment, Dried Sludge and vegetation		

SAMPLING:

Quantity Required	0.08 to 0.4 g
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Phosphorus compounds are converted to orthophosphate by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is filtered and the filtrate is analyzed using an automated colourimetric system.

Total Kjeldahl Nitrogen is determined simultaneously.

INSTRUMENTATION:

Hot plate

Basic automated modular continuous flow system: Colourimetric measurement is through a 5 cm. light path at 660 nm.

Data capture and processing is via a computer system

REPORTING:

Max. Significant Figures: 3	Current W value: 0.02	Current T value: 0.10	Full Scale: 2.0 mg/L

CALIBRATION:

3 High and 2 Low Calibration Standards

PHOSPHORUS, TOTAL cont'd

CONTROLS:

Drift	Run 80% calibration standard for every 10 samples
Recovery	3 digested BL's plus 4 digested standards R1, R2, R3 and R4

NOTES:

System is calibrated with undigested standards. QCA, QCB and QCC were introduced in April 2003. February 2004, Method E3118 was amalgamated with E3116. Data capture/processing is done by the "Labtronic

PHOSPHORUS, TOTAL (E3116)

Analytical Range: to 2.0 mg/g as P

Calibration Control: (mg/L as P)

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	18	1.6	1.597	-0.003	0.009
B	18	0.8	0.804	0.004	0.010
C	18	0.2	0.198	-0.002	0.007
A + B	18	2.4	2.401	0.017	0.017
A - B	18	0.8	0.793	-0.009	0.009
B + C	18	1	1.002	0.002	0.012
B - C	18	0.6	0.606	0.006	0.013

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0097
	Within Runs	0.0063
	Between/Within	1.54
s.d.(BC)	Between Runs	0.0092
	Within Runs	0.0089
	Between/Within	0.97

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	2.432	2.368	2.464	2.336
A - B	0.832	0.768	0.848	0.752
B + C	1.015	0.985	1.03	0.970
B - C	0.615	0.585	0.622	0.578

Duplicates:

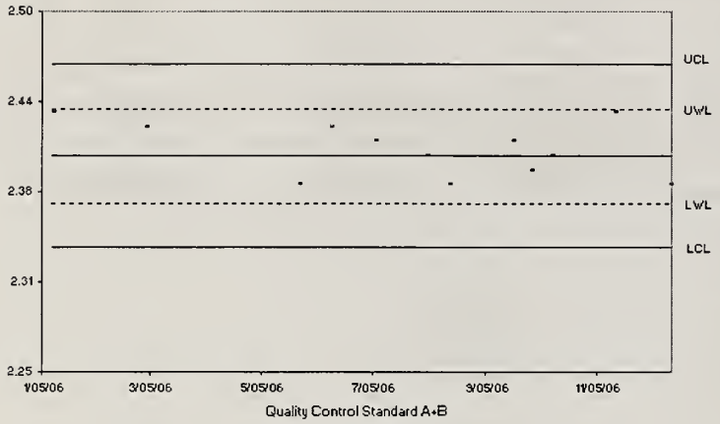
Number	Concentration	Std. Dev.	% Coeff of Var
53	0.0 - 10.0	0.057	3.68
1	10.1 - 20.0	N/A	N/A
0	20.1 - 50.0	N/A	N/A
0	50.1 - 100	N/A	N/A
54	Total	0.058	3.34

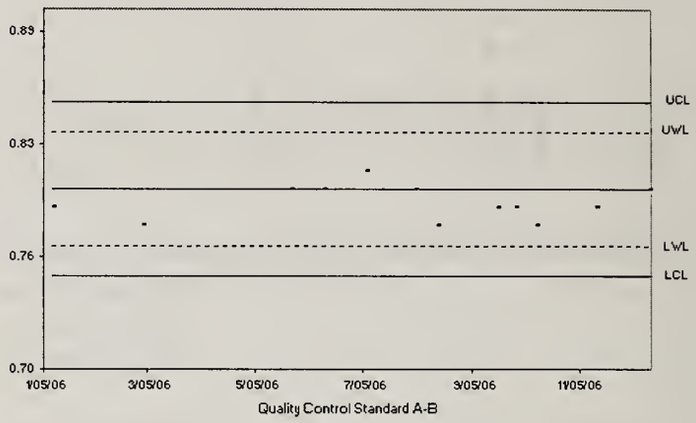
Recoveries:	number	Expected	Mean	Std. Dev. (1)
R1	18	1.05	1.062	0.015
*RS-92	18	0.47	0.466	0.029
*RSM-2781	18	24.00	25.148	0.664
*Pine Needles	5	1.2	1.184	0.035

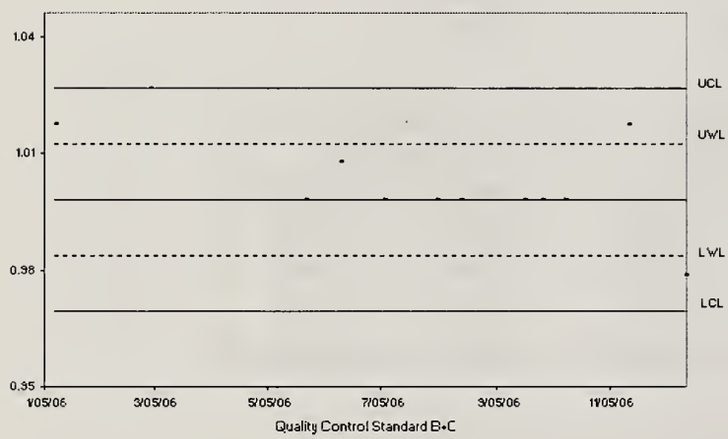
* are measured in mg/g

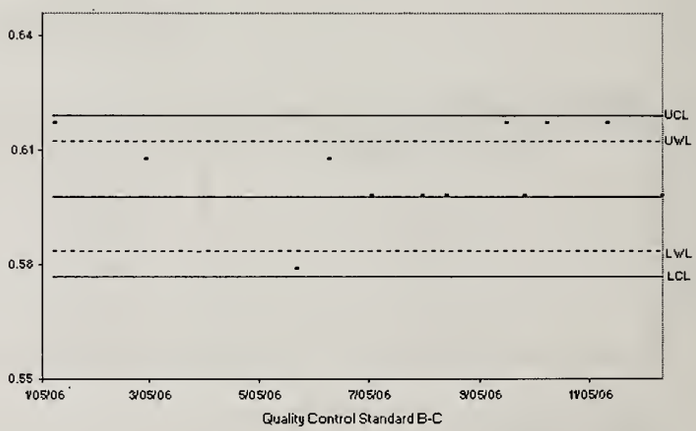
Other Checks	Number	Mean	Std. Dev.
LTB	15	0.013	0.053
Digested Blank	14	0.003	0.010

PHSOPHORUS, TOTAL (E3116)
QUALITY CONTROL FROM 01/10/2006 TO 12/15/2006
Analytical Range: to 2.0 mg/L as P









PHOSPHORUS, TOTAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3367	Reporting Unit	mg/L as P
LIMS Product Code	TOTNUT3367	Supervisor	P.Wilson
Sample Type/Matrix	Precipitation, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservatives	None

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digesters kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line and then orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.
Approximate absorbance: 0.4 at the full scale level.
Total Kjeldahl nitrogen is determined simultaneously.

INSTRUMENTATION:

Three Block digesters
Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using appropriate phototube.
Data capture and processing is via a computer system

REPORTING:

Max. Significant Figures: 3	Current W value: 0.002	Current T value: 0.010	Full Scale: 0.200 mg/L

CALIBRATION:

BL plus 7 undigested standards

PHOSPHORUS, TOTAL cont'd

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL , undigested standard , BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTE:

The HP capture / processing system was replaced by "Labtronics" Data Acquisition software in May 1999.

PHOSPHORUS; TOTAL (E3367)

Analytical Range: to 0.200 mg/L as P

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	61	0.160	0.1610	0.0010	0.0012
B	61	0.080	0.0807	0.0007	0.0007
C	61	0.016	0.0155	-0.0005	0.0007
A + B		0.240	0.2416	0.0016	0.0016
A - B		0.080	0.0803	0.0003	0.0010
B + C		0.096	0.0962	0.0002	0.0011
B - C		0.064	0.0651	0.0011	0.0009

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.001
	Within Runs	0.0007
	Between/Within	1.43
s.d.(BC)	Between Runs	0.0007
	Within Runs	0.0006
	Between/Within	1.17

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	0.2366	0.2434	0.2332	0.2468
A - B	0.0766	0.0834	0.0749	0.0854
B + C	0.094	0.098	0.092	0.10
B - C	0.062	0.066	0.061	0.067

Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
118	0 - 10%	0.006	64.2
34	10 - 20%	0.004	14.5
14	20 - 50%	0.021	37.5
1	50 - 100%	N/A	N/A
167	Total	0.008	45

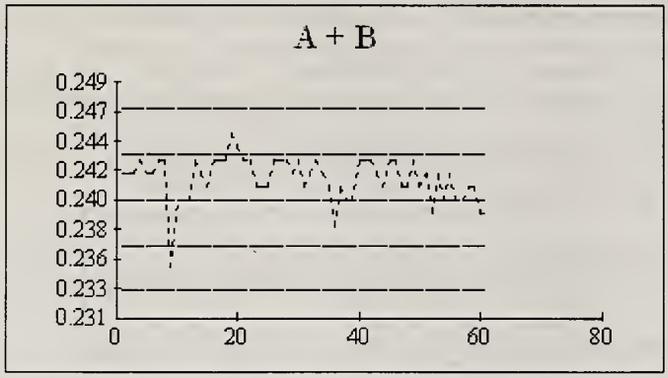
Recoveries

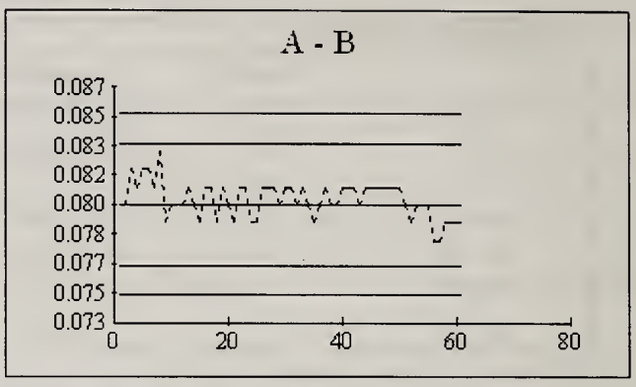
Number	Expected	Mean	Std. Dev.
61	0.14	0.133	0.024
61	0.084	0.083	0.011
61	0.028	0.031	0.016

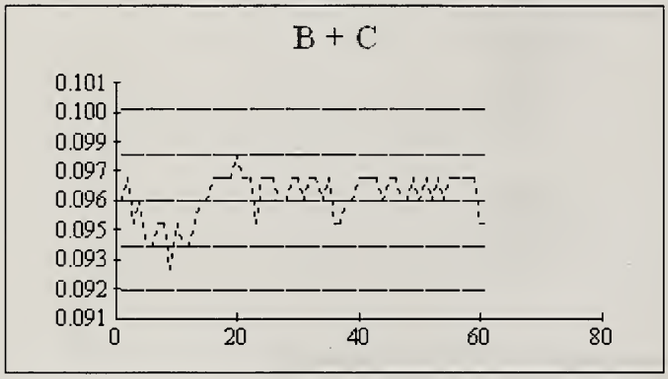
Other Checks	Number	Mean	Std. Dev.
LTB	61	-0.0002	0.0004
Digested Blank	61	0.0015	0.0038

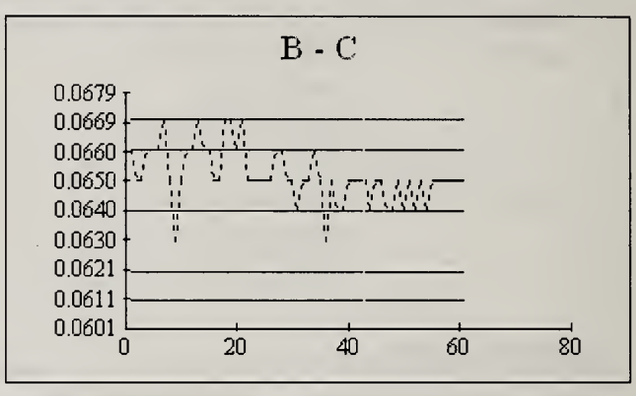
Phosphorus; total (E3367)

QC Data; 1/1/2006 to 12/31/2006









PHOSPHORUS, TOTAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3368	Reporting Unit	mg/L as P
LIMS Product Code	TOTNUT3368	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Raw Sewage, Industrial Waste, Effluent, Ground Water, Process Water, Leachate, Precipitation, Surface Water.		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line and then orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.
Approximate absorbance: 0.8 at the full scale level.
Total Kjeldahl Nitrogen is determined simultaneously.

INSTRUMENTATION:

3-Block digesters
Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using an IR sensitive phototube. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.02	Current T value: 0.10	Full Scale: 10.0 mg/L

CALIBRATION:

BL plus 7 standards

PHOSPHORUS, TOTAL cont'd

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,undigested standard, BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

System is calibrated with undigested standards.
The HP capture / processing system was replaced by "Labtronics" Data Acquisition software in April 1999
WP and WS matrices were added in October 2005.

PHOSPHORUS; TOTAL (E3368)

Analytical Range: to 10.0 mg/L as P

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	33	8	7.9939	-0.0061	0.0408
B	33	4	3.9979	-0.0021	0.0233
C	33	0.8	0.8006	0.0006	0.0106
A + B		12	11.9918	-0.0082	0.0503
A - B		4	3.9961	-0.0039	0.0434
B + C		4.8	4.7985	-0.0015	0.0250
B - C		3.2	3.1973	-0.0027	0.0261

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0332
	Within Runs	0.0307
	Between/Within	1.08
s.d.(BC)	Between Runs	0.0181
	Within Runs	0.0185
	Between/Within	0.98

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	11.935	12.065	11.870	12.130
A - B	3.935	4.065	3.903	4.097
B + C	4.766	4.834	4.732	4.868
B - C	3.166	3.234	3.149	3.251

Duplicates:

Number	Concentration	Std. Dev.	% Coeff. of Var.
78	0 - 10%	0.04	21.4
1	10 - 20%	N/A	N/A
1	20 - 50%	N/A	N/A
3	50 - 100%	0.069	1.3
83	Total	0.042	9.8

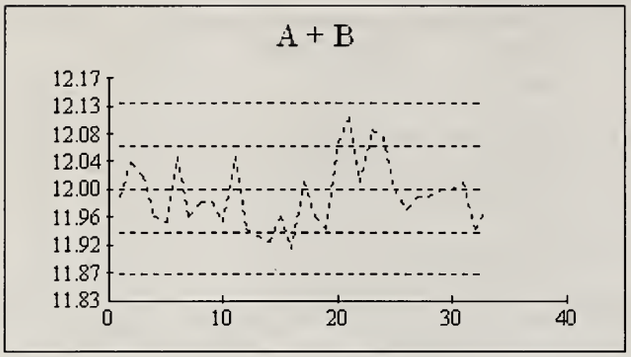
Recoveries

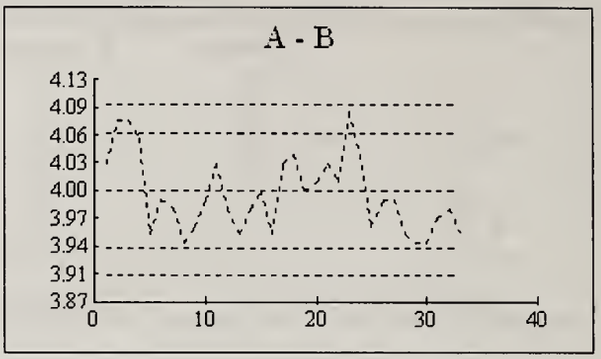
Number	Expected	Mean	Std. Dev.
32	7	6.862	0.164
32	4.2	4.15	0.081
32	1.4	1.388	0.037

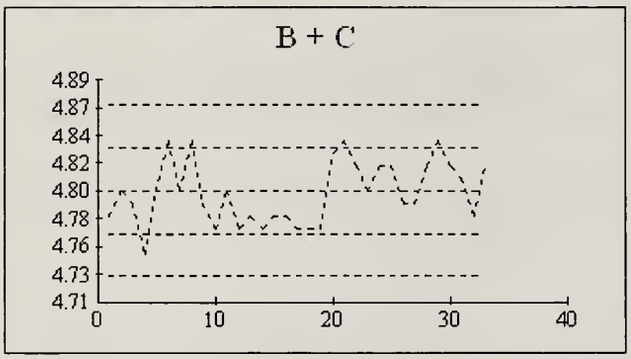
Other Checks	Number	Mean	Std. Dev.
LTB	33	0.0136	0.0358
Digested Blank	33	0.0084	0.0255

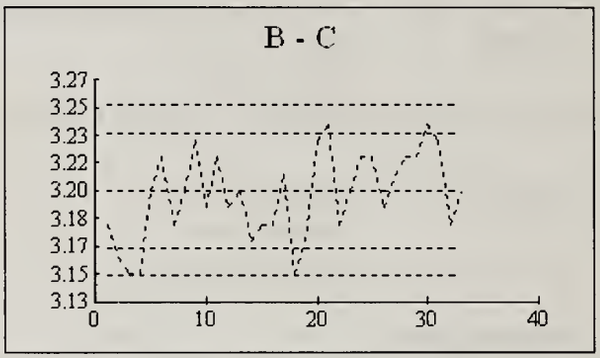
Phosphorus; total (E3368)

QC Data; 1/1/2006 to 12/31/2006









SILICON, REACTIVE SILICATES

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status: Yes ☑	Licensed (Drinking Water): ☑
	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/02/75
Method Reference No.	E3370	Reporting Unit	mg/L as Si
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Reactive silicates are determined by formation of a reduced molybdo-silicate complex at pH 1.6, using ascorbic acid as the reducing agent, and oxalic acid to suppress phosphate interference.
Approximate absorbance: 0.7 at the full scale level.
Dissolved inorganic and dissolved organic carbon are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 660 nm. Data capture and processing is via a computer system.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.02	Current T value: 0.10	Full Scale: 10.0 mg/L

CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL, standard and BL every 10 samples.

NOTES:

December 1998: The HP data capture/processing system was replaced by "Labtronics" Data Acquisition

Silicon; reactive silicate (E3370)
QUALITY CONTROL DATA FROM 01/01/2006 TO 12/31/2006
Analytical Range; to 10.0 mg/L as Si

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	46	8	7.997	-0.003	0.052
B	46	2	2.006	0.006	0.031
C	46	0.5	0.469	-0.031	0.027
A + B		10	10.003	0.003	0.076
A - B		6	5.991	-0.009	0.038
B + C		2.5	2.475	-0.025	0.056
B - C		1.5	1.537	0.037	0.016

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0425
	Within Runs	0.0269
	Between/Within	1.58
s.d.(BC)	Between Runs	0.0291
	Within Runs	0.0113
	Between/Within	2.58

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	9.83	10.17	9.66	10.34
A – B	5.83	6.17	5.75	6.25
B + C	2.43	2.57	2.37	2.63
B – C	1.43	1.57	1.4	1.6

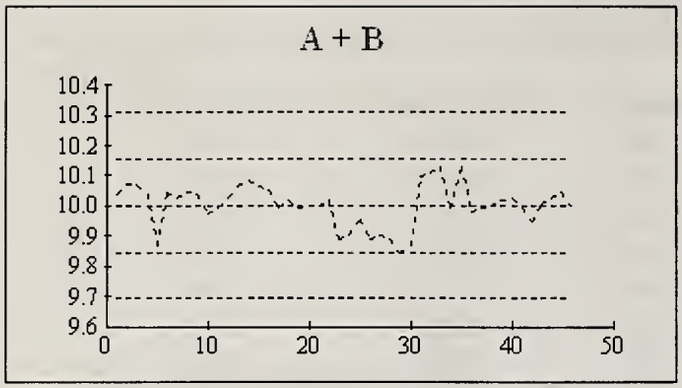
Duplicates:

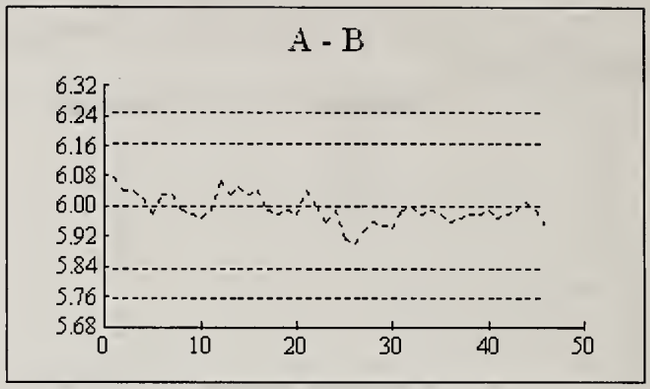
Number	Concentration	Std. Dev.	% Coeff of Var
67	0 - 10%	0.008	1.821
27	10 - 20%	0.009	0.638
22	20 - 50%	0.018	0.609
12	50 - 100%	0.027	0.445
128	Total	0.013	0.81

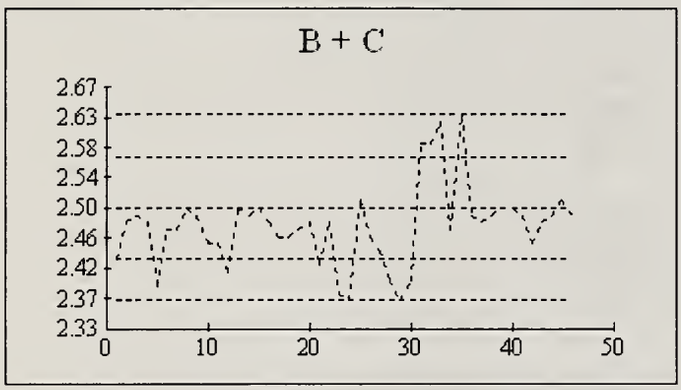
Other Checks	Number	Mean	Std. Dev.
LTB	46	-0.043	0.034

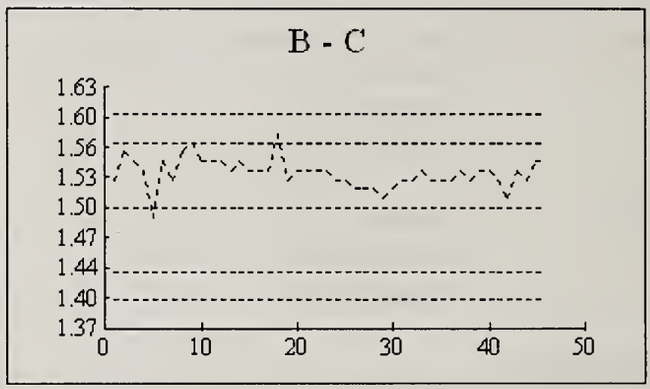
Silicon; reactive silicate (E3370)

QC Data; 1/1/2006 to 12/31/2006









SOLIDS, DISSOLVED

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No ____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TSD3188,DS3188	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	125 mL – 200 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Sample is filtered under moderate suction through a Whatman 934AH grade glass fibre filter. Generally 100 mL of filtrate (alternate 50 mL) is pipetted into a preweighed Teflon dish, dried at 103±2°C, and stored in a desiccator for at least 24 hours. The dissolved solids content is calculated by subtracting the original dish mass from the dried residue + dish mass. Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (4 decimal places), drying oven, suction filtration apparatus, dishes (Teflon).
Computer system with appropriate software.

REPORTING:

Max. Significant Figures: 3	Current W value: 10	Current T value: 50	Full Scale: N/A

CALIBRATION:

Balance zero
Balance internal calibration is performed daily.

CONTROLS:

Calibration	2 S class weights, e.g. QCA & QCB (results in grams)
Drift	Balance is reset to zero after every 10 weighings
Recovery	2 standards, e.g. R1 & R3
Method Blank	100 mL Pure Water.

SOLIDS, DISSOLVED (E3188)

QUALITY CONTROL DATA FROM 01/17/2006 TO 12/13/2006

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	38	50	50.00004	0.0000	0.00006
B	38	30	30.00007	0.0001	0.00005
A + B	38	80	80.0001	0.0001	0.00009
A - B	38	20	20	0.0000	0.00006

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.00005
	Within Runs	0.00004
	Between/Within	1.37

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	80.0000	80.0002	79.9999	80.0003
A - B	19.9998	20.0001	19.9998	20.0001

Recoveries:

	Number	Expected	Average	Std. Dev. (1)
R1	38	2000	1994.9	10.74
R2	38	500	496.19	6.23

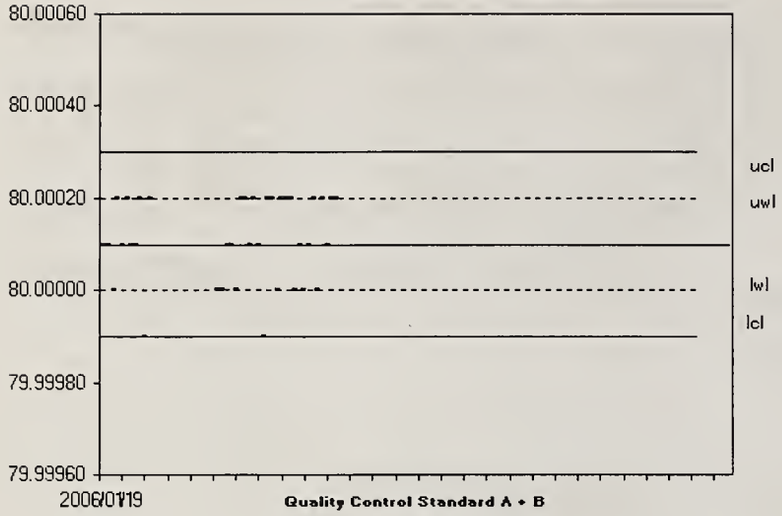
Duplicates:

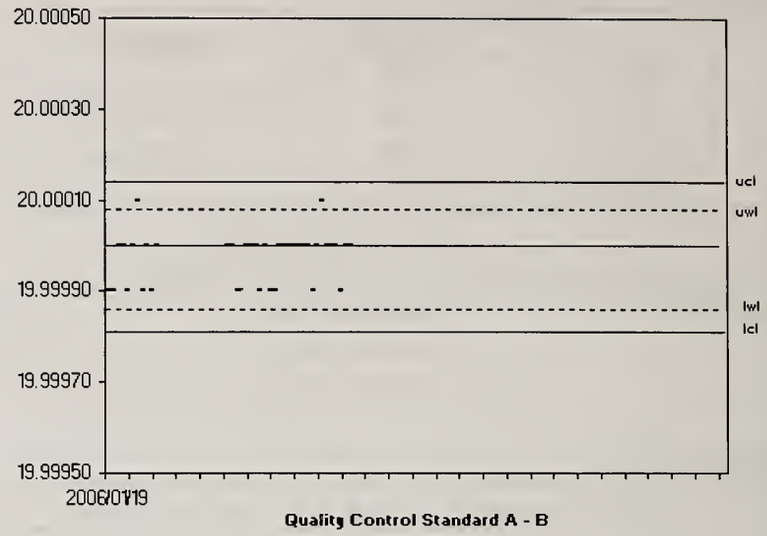
Number	Concentration	Std. Dev.	% Coeff of Var
7	0 - 500	2.3984	0.8466
55	501 - 1000	9.132	1.3443
11	1001 - 10000	30.7776	1.5615

OTHER CHECKS	Number	Data Mean (mg/L)	Std. Dev. (1)
Blank	35	0.192	3.1022

SOLIDS, DISSOLVED (E3188)

QUALITY CONTROL DATA FROM 01/17/2006 TO 12/13/2006





SOLIDS, SUSPENDED

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '81
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TSD3188, SS3188, SIGN	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	2-500 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

2 to 500 mL is pipetted or quickly poured from a shaken sample into a graduated cylinder, and the volume is measured. The aliquot is then filtered under moderate suction through a preweighed Whatman 934AH glass fibre filter. The graduated cylinder and then the filter are washed with a total of 50 mL distilled water. The filter is dried at 103-105^{0}C, and the suspended solids content is calculated by subtracting the original filter mass from the dried filter mass. Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (5-decimal places), drying oven, suction filtration apparatus.
Computer system with appropriate software.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.5	Current T value: 2.5	Full Scale: N/A

CONTROLS:

Calibration	2 S class weights, e.g. QCC & QCD (results in grams)
Drift	Balance is reset to zero after every 10 weighings.
Recovery	2 standards, e.g. R1 & R2
Method Blank	Filter washed with 500 mL distilled water

SOLIDS, SUSPENDED cont'd

NOTES:

A correction factor is applied to all filters to account for weight loss during filtering.
A new set of Q.C. weights was introduced for the year 2003, along with new limits for the weights.

SOLIDS, SUSPENDED (E3188)

Quality Control Data from 01/06/2006 to 12/21/2006

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
C	217	0.50000	0.50000	0.00000	0.00000
D	217	0.05000	0.05000	0.00000	0.00000
C + D	217	0.55000	0.55000	0.00000	0.00001
C - D	217	0.45000	0.45000	0.00000	0.00001

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.00000
	Within Runs	0.00000
	Between/Within	0.940

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	0.55002	0.54998	0.54996	0.55004
A - B	0.45002	0.44998	0.44997	0.55003

RECOVERIES:

	Number	Expected (mg/L)	Mean (mg/L)	Std. Dev. (1)
R1	217	200	193.63	1.85768
R2	216	50	48.5296	0.90737

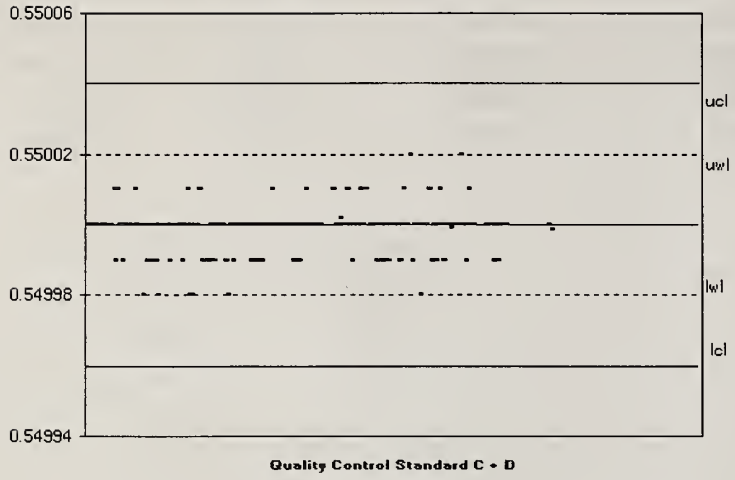
Duplicates:

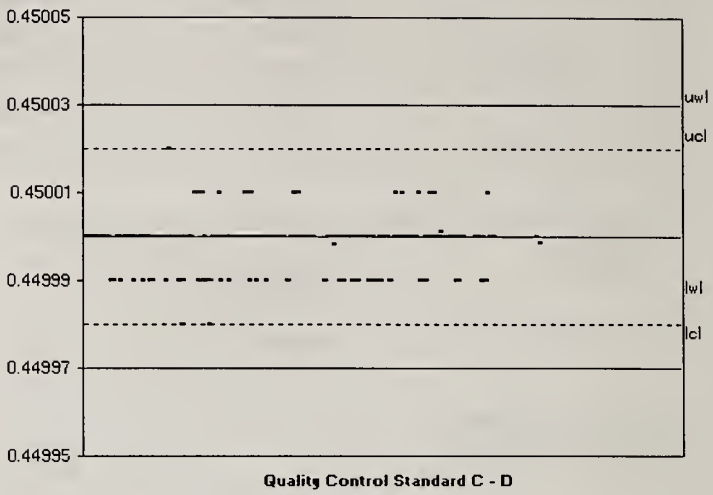
Number of Pairs	Concentration	Std. Dev.	% Coeff of Var
372	0.0 - 5	0.19	7.64
134	5.1 - 10	0.37	5.31
121	10.1 - 25	0.51	3.43
75	25.1 - 100	1.91	3.92
15	100.1 - 500	8.36	4.63
6	501 - 1000	29.29	4.61
7	1001 - 20000	159.4	1.27
630	total	17.10754	10.63721

Other Check:	Number	Mean Data mg/L	Std. Dev. (1)
Blank	217	0.00853	0.06486

SUSPENDED, SOLIDS (E3188)

Quality Control Data from 01/06/2006 to 12/21/2006





SOLIDS, SUSPENDED IGNITED
(Particulate Ash and Particulate Loss On Ignition)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	SIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Raw Sewage, Industrial Waste, Process Water		

SAMPLING:

Quantity Required	2-500 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

The procedure for particulate solids (SS3188) is followed and the dried residue is ignited at 600±50^{0}C for one hour in a muffle furnace. The dish is transferred to a desiccator to cool. The particulate ash (fixed solids) is the difference between the final ignited mass plus filter and the original tare weight of the filter, divided by the original sample volume (mL) used for SS3188. The particulate loss on ignition (estimate of volatile suspended solids) is the difference between the final ignited mass plus filter and the residue (suspended solids) plus filter, divided by the original sample volume (mL). Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (5 decimal places), muffle furnace, filters, Petri dishes
Computer system with appropriate software

REPORTING:

Max. Significant Figures: 3	Current W value: 0.5	Current T value: 2.5	Full Scale: N/A

CONTROLS:

Calibration	2 S class weights, e.g. QCC & QCD (results in grams)
Drift	Balance is reset to zero after every 10 weighings.
Recovers	R1 & R2
Blank	

SOLIDS, SUSPENDED IGNITED (E3188)

QUALITY CONTROL DATA FROM 01/17/2006 TO 12/13/2006

Calibration Control:

	Number	Expected (g)	Mean (g)	Mean Bias (g)	Std. Dev. (1)
C	12	0.50000	0.50000	0.0000	0.00001
D	12	0.05000	0.05000	0.0000	0.00000
C + D	12	0.55000	0.55001	0.0000	0.00001
C - D	12	0.45000	0.45000	0.0000	0.00001

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.000005
	Within Runs	0.000005
	Between/Within	0.946

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	0.5500	0.5502	0.54997	0.55003
A - B	0.44999	0.450013	0.44998	0.45002

SOLIDS, SUSPENDED IGNITED (PARTICULATE ASH)

Duplicates:

Number	Concentration (mg/L)	Std. Dev. (2)	% Coeff of Var
16	0 - 10	0.15	4.29
6	10.1 - 20.0	0.98	7.57
3	20.1 - 100.0	0.19	0.52
4	100.1 - 1000	15.28	4
7	1001 - 6000	77.32	2.12

OTHER CHECKS	Number	Mean (mg/L)	Std. Dev. (1)
Blank	12	0.11	0.170

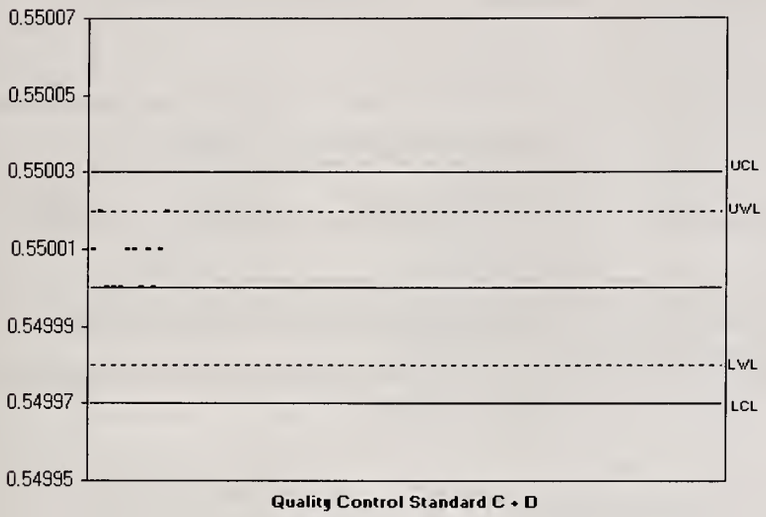
SOLIDS, LOSS ON IGNITION

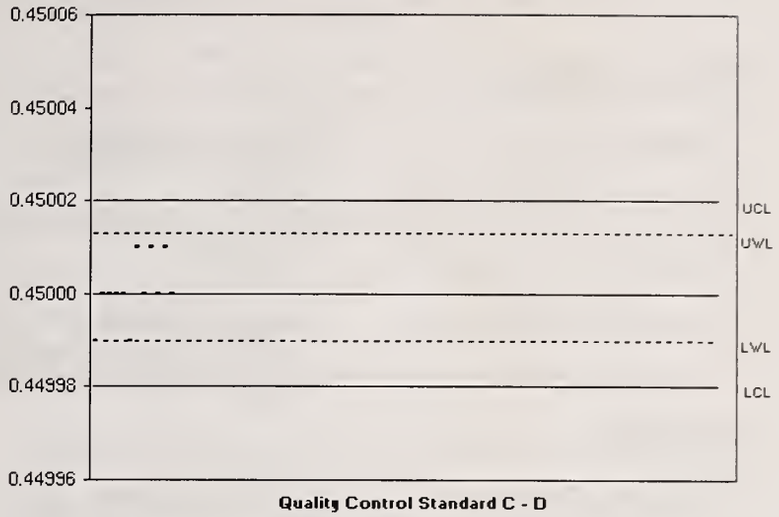
Duplicates:

Number	Concentration (mg/L)	Std. Dev. (1)	% Coeff of Var
19	0 - 10.0	0.22	6.04
2	10.1 - 20.0	0.13	0.84
8	20.1 - 100.0	2.03	3.72
0	100.1 - 1000	N/A	N/A

OTHER CHECKS	Number	Mean (mg/L)	Std. Dev. (1)
Blank	12	-0.16	0.133

SOLIDS, SUSPENDED IGNITED (E3188)
PARTICULATE ASH AND PARTICULATE LOSS ON IGNITION
QUALITY CONTROL DATA FROM 01/27/2006 TO 12/12/2006





SOLIDS, TOTAL

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '81
Method Reference No.	E3188	Reporting Unit	mg/L or mg/Kg
LIMS Product Code	TS3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	125 mL – 250 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Generally, 100 mL aliquot of sample (alternate 50 mL) is pipetted into a preweighed Teflon dish, dried at 103-105^{0}C, and stored in a desiccator for at least 24 hours. The total residue or solids content is calculated by subtracting the original dish mass from the dried dish mass. Data collection, calculations, and transfer of result to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (4 decimal places), drying oven, dishes (Teflon).
Computer system with appropriate software.

REPORTING:

Max. Significant Figures: 3	Current W value: 10.0	Current T value: 50.0	Full Scale: N/A

CALIBRATION:

Balance zero
Balance internal calibration performed daily.

CONTROLS:

Calibration	2 S class weights, e.g. QCA & QCB (results in grams)
Drift	Balance is reset to zero after every 10 weighings.
Recovery	2 standards, e.g. R1 & R2
Blank	

SOLIDS, TOTAL (E3188)

QUALITY CONTROL DATA FROM 01/17/2006 TO 12/13/2006

Calibration Control:

	Number	Expected (g)	Mean (g)	Mean Bias (g)	Std. Dev.
A	10	50	50	0.0000	0.00009
B	10	30	30.0001	0.0000	0.00005
A + B	10	80	80.0001	0.0001	0.00013
A - B	10	20	20	-0.0001	0.00005

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.00007
	Within Runs	0.00004
	Between/Within	1.93

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	79.99996	80.00018	79.99986	80.00028
A - B	20.000016	19.99994	19.99979	20.00011

Recoveries:

	Number	Expected (g)	Mean (g)	Std. Dev. (1)
R1	8	20000	20025.1	128.27
R2	10	2000	1996.84	7.48

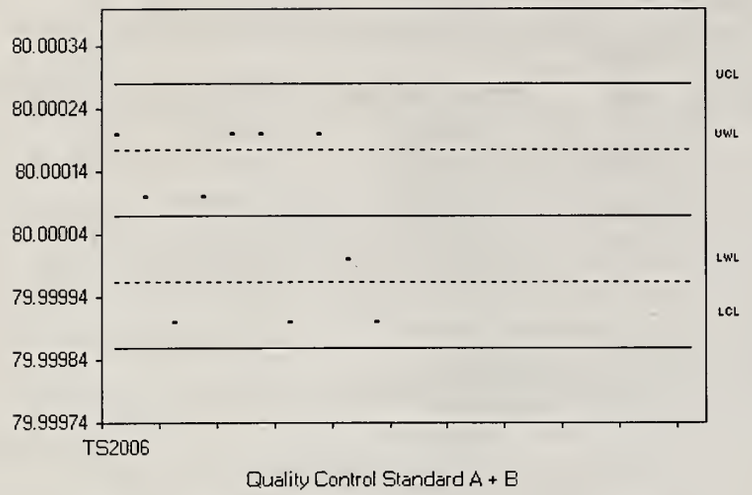
Duplicates:

Number	Concentration (mg/L)	Std. Dev.	% Coeff of Var
3	0.0 - 6000	19.12	1.485
6	6001 - 20000	79.20	0.553
4	20001 - 35000	126.77	0.427
5	35001 140000	1466.47	1.973

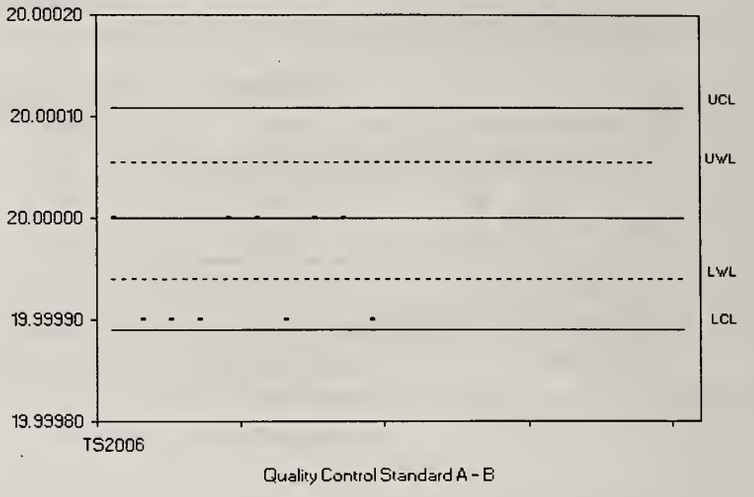
OTHER CHECKS	Number	Data Mean (mg/L)	Std. Dev. (1)
Blank	10	-0.782	3.48

SOLIDS, TOTAL (E3188) (mg/L)

QUALITY CONTROL DATA FROM 06/27/2006 TO 12/29/2006



Quality Control Standard A + B



Quality Control Standard A - B

SOLIDS, TOTAL IGNITED
(Ash and Loss On Ignition)

CCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

ENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water		

AMPLING:

Quantity Required	5-500 mL
Container	Glass or plastic
Preservative(s)	None

NALYTICAL PROCEDURE:

The procedure for total solids (TS3188) is followed and the dried residue is ignited at 600±50°C for one hour in a muffle furnace. The dish is transferred to a desiccator to cool. The ash (fixed solids) is the difference between the final ignited mass dish and the original tare weight of the dish, divided by the original sample volume (mL) used for TS3188. The loss on ignition (estimate of volatile total solids) is the difference between the final ignited mass plus dish and the residue (total solids) plus dish, divided by the original sample volume (mL). Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

STRUMENTATION:

Balance (4 decimal places), muffle furnace, filters, ceramic dishes.
Computer system with appropriate software.

EPORTING:

Max. Significant Figures: 3	Current W value: 10.0	Current T value: 50.0	Full Scale: N/A

ONTROLS:

Calibration	2 S class weights, e.g. QCA & QCB (results in grams)
Drift	Balance is reset to zero after every 10 weighings.
Recovery	2 stds. eg. R1
Blank	

SOLIDS TOTAL, IGNITED (3188)
(Ash and Loss on Ignition)

Calibration Control:

	Number	Expected (g)	Mean (g)	Mean Bias (g)	Std. Dev. (1)
A	29	50	50	0.0000	0.00006
B	29	30	30.0001	0.0001	0.00005
A + B	29	80	80.0001	0.0001	0.00010
A - B	29	20	20	0.0000	0.00005

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.00006
	Within Runs	0.00003
	Between/Within	1.66

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	80	80.0002	79.9999	80.0003
A - B	20.00015	19.99985	20.0001	16.9999

SOLIDS, TOTAL IGNITED (DRY)

Recoveries:

	Number	Expected (mg/L)	Mean (mg/L)	Std. Dev. (1)
R1	28	20000	19999.5	150.38
R2	29	2000	1995.45	14.6

Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
27	0 - 500	4.86	1.17
29	501 - 1000	7.91	1.27
12	1001 - 5000	86.1	4.45
3	5001 - 10000	225.5	3.74
11	10001 - 40000	280.2	1.57

OTHER CHECKS

	Number	Data Mean (mg/L)	Std. Dev. (1)
Blank	29	1.45	3.376

SOLIDS, TOTAL IGNITED (ASH)

Recoveries:

	Number (mg/L)	Average (mg/L)	Std. Dev (1)
R1	29	19865.45	277.89
R2	29	1979.93	15.93

Duplicates:

Number	Concentration (mg/L)	Std. Dev. (2)	% Coeff of Var
50	0 - 500	4.30	1.42
10	501 - 1000	6.39	0.99
12	1001 - 5000	85.59	3.96
14	5001 - 20000	92.90	1.45

OTHER CHECKS

	Number	Data Mean (mg/L)	Std. Dev. (1)
Blank	28	2.91	2.52

Recoveries:

	Number	Average	Std. Dev. (1)
R1	29	94.07	67.01
R2	29	16.07	4.83

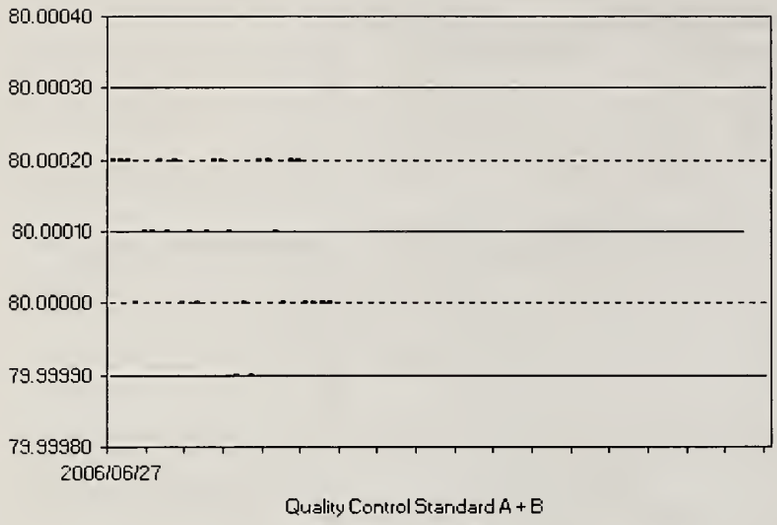
Duplicates:

Number	Concentration (mg/L)	Std. Dev.	% Coeff of Var
65	0 - 500	7.95	3.92
4	501 - 1000	29.53	3.03
7	1001 - 5000	67.77	1.09
10	5001 - 20000	73.45	0.55

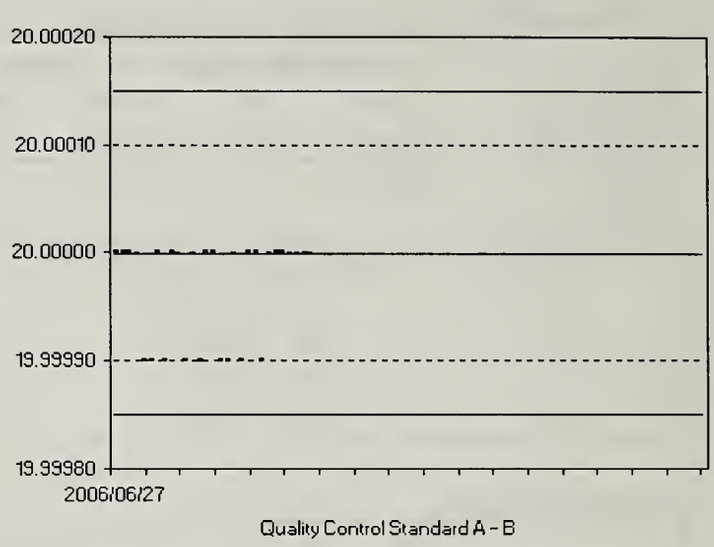
OTHER CHECKS

	Number	Data Mean (mg/L)	Std Dev. (1)
Blank	28	-1.36	3.85

SOLIDS, TOTAL IGNITED (mg/L)
QUALITY CONTROL DATA FROM 01/27/2006 TO 12/29/2006



Quality Control Standard A + B



Quality Control Standard A - B

SULPHATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory Unit	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Units	$\mu g/m^3$ as SO_4
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	3/4" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube
Preservative(s)	None

SAMPLING PREPARATION:

A 3/4" strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Sulphate separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of sulphate (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation is made. The result is reported as $\mu g/m^3$ as SO_4.
Chloride and nitrate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.1 $\mu g/m^3$	Current T value: 0.5 $\mu g/m^3$	Full Scale: 28.6 $\mu g/m^3$

CALIBRATION:

9 standards

SULPHATE cont'd

CONTROLS:

Calibration	MB, QCA and QCB
Drift	2 standards every 20 samples
Recovery	CS4 & CS5

NOTES:

To convert unit from mg/L to µg/m^3, the final concentration of SO_4 in µg/m^3 is calculated by the following formula:

Result (mg/L) X 50mL X (63/6.75) / air volume = µg/m^3

where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

Calibration control standards and in house control standards (CS4 & CS5) are reported in mg/L.

SULPHATE (E3004)

QUALTIY CONTROL DATA FROM 01/05/2006 TO 09/24/2006

Analytical Range: to 28.61 µg/m³ (100mg/L)

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
***A**	8	80	81.6439	1.6439	3.2497
***B**	8	20	19.834	-0.166	0.1661
***A + B**	8	100	101.4779	1.4779	3.3024
***A - B**	8	60	61.8099	1.8099	3.2047

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	2.30
	Within Runs	2.66
	Between/Within	1.01

Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
*A + B	98.67	101.33	97.35	102.65
*A - B	58.67	61.33	58.01	61.99

In House Control standard for 01/05/06 to 09/24/2006

	Number	Expected	Mean	Mean Bias	Std. Dev. (1)
*CS4	8	41.17	41.01	-0.15	0.5033
*CS5	8	34.69	34.29	-0.39	0.9136

The calibration is accepted if the calibration control values obtained lie within the range:

*36.88	-	43.72	for CS4
*32.40	-	36.96	for CS5

Duplicates:

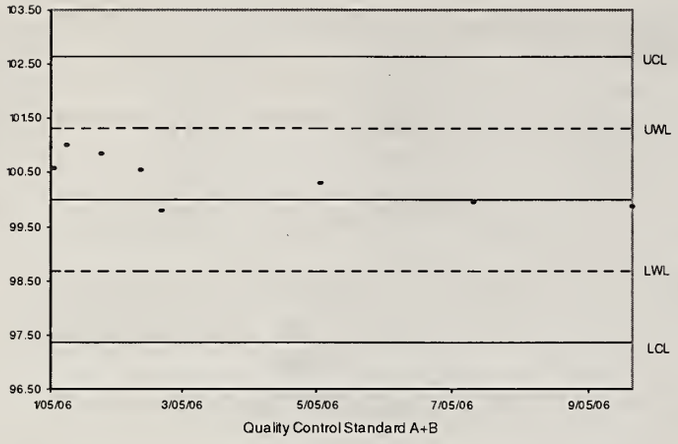
Number	Concentration	Std. Dev.	% Coeff of Var
7	0.0 - 2.86	0.3874	4.1
4	2.89 - 7.15	0.0936	2.7
4	7.18 - 14.31	1.2183	7
0	14.33 - 28.61	N/A	N/A
15	Total	0.6829	11.1

*Results reported in mg/L

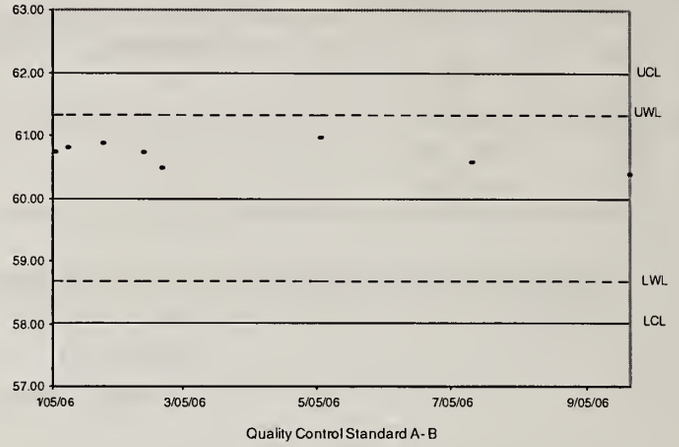
SULPHATE (E3004)

QUALTIY CONTROL DATA FROM 01/05/2006 TO 09/24/2006

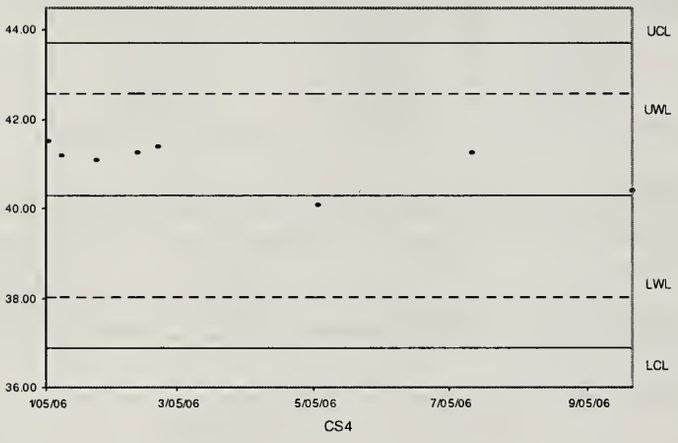
Analytical Range: to 100mg/L



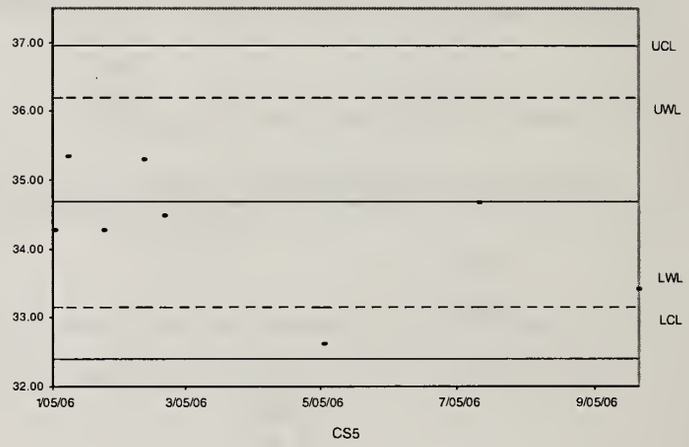
Quality Control Standard A+B



Quality Control Standard A-B



CS4



CS5

SULPHATE

CCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status: Yes_☑_ No _____	Licensed (Drinking Water): N/A
	Reportable Limit (OSDWA): N/A

DENTIFICATION:

Laboratory Unit	Water Chemistry	Method Introduced	01/01/86
Method Reference No.	E3013	Units	µg/g as SO_4
LIMS Product Code	ANION3013, SUL3013	Supervisor	P. Wilson
Sample Type/Matrix	Soil and Sediment		

AMPLING:

Quantity Required	20 g
Container	glass or plastic
Preservative(s)	None

AMPLING PREPARATION:

A 3.0 g sample of air dried, sieved soil or air dried sieved and ground sediment is placed in a 50 mL centrifuge tube and shaken with 30 mL Pure-DW for 1 hour on a shaker. Samples are centrifuged, membrane filtered and analyzed for chloride and sulphate by ion chromatography.

NALYTICAL PROCEDURE:

Sulphate is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of sulphate (mg/L) is determined by the comparison of the analyte peak area count to those of a series of standards. The result is reported as µg/g as SO_4.
Chloride is determined simultaneously.

NSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

EPORTING:

Max. Significant Figures: 3	Current W value: 0.5 µg/g	Current T value: 2.5 µg/g	Full Scale: 1000 µg/g

ALIBRATION:

9 standards

SULPHATE cont'd

CONTROLS:

Calibration	MB, QCA and QCB
Recovery	R21, SO201, SO202, R23, R16
Drift	2 standards every 20 samples

NOTES:

R21, SO201 and SO202 were introduced October, 2003.

Calibration control standards are reported in mg/L.

SULPHATE (E3013)

QUALITY CONTROL DATA FROM 01/19/2006 TO 10/04/2006

Analytical Range: to 1000 µg/g (100 mg/L)

Calibration Control: (mg/L)

	Number	Expected	Mean	Mean Bias	Std. Dev.
***A**	3	80	80.23	0.23	0.2318
***B**	3	20	19.76	-0.24	0.0671
***A + B**	3	100	99.99	-0.013	0.2781
***A - B**	3	60	60.47	0.47	0.1978

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.14
	Within Runs	0.17
	Between/Within	1.22

Control Limits: (mg/L)

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
*A + B	98.55	101.45	97.10	102.90
*A – B	58.55	61.45	57.82	62.18

Duplicates: (µg/g)

Number	Concentration	Std. Dev.	% Coeff of Var
6	0.00 – 200.00	5.6856	8.8
1	201 – 500	N/A	N/A
0	501 – 1000	N/A	N/A
7	Total	7.6288	6.6

Recoveries: (µg/g)

	Number	Expected	Mean	Std. Dev
SO201	3	73.2	77.90	3.67
SO202	3	445.4	376.13	48.76
R21	3	44.6	43.98	2.97
R16	3	46.4	40.27	1.12
R23	2	5400	5245.086	N/A

The calibration is accepted if the calibration control values obtained lie within the range:

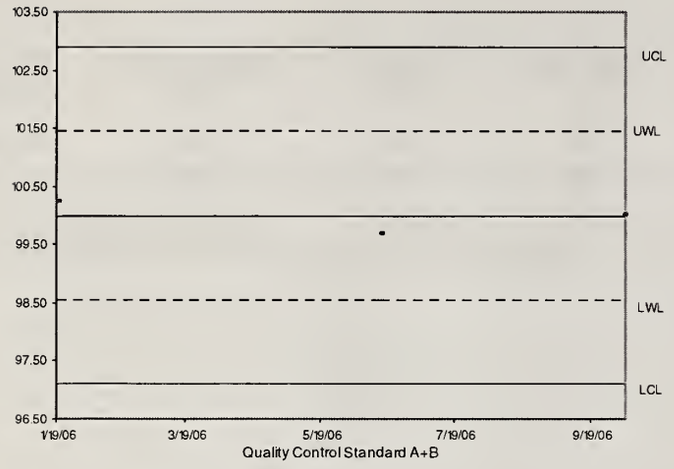
25.5	-	67.3	for R16
24.5	-	64.7	for R21
40.3	-	106.1	for SOS201
245	-	645.8	for SOS202

* Results reported in mg/L

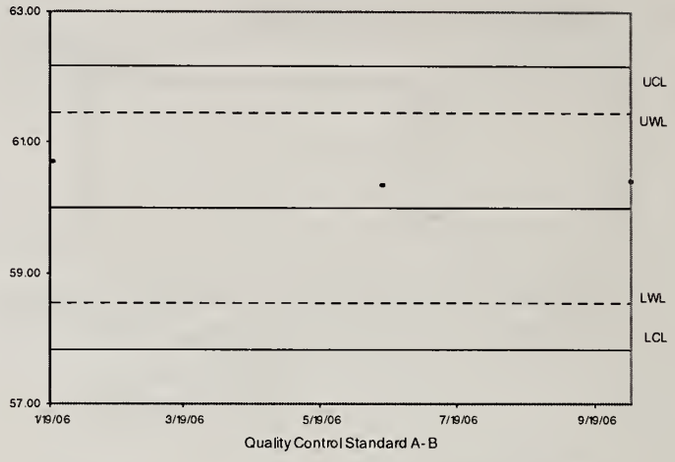
SULPHATE (E3013)

QUALITY CONTROL DATA FROM 01/11/2006 TO 10/05/2006

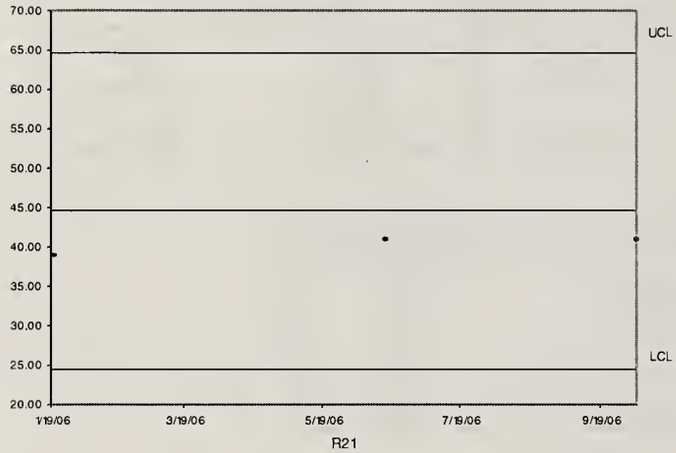
Analytical Range: to 100mg/L



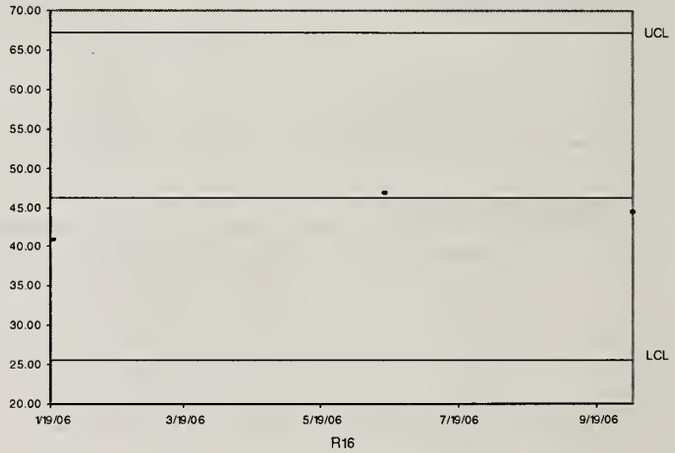
Quality Control Standard A+B



Quality Control Standard A-B



R21



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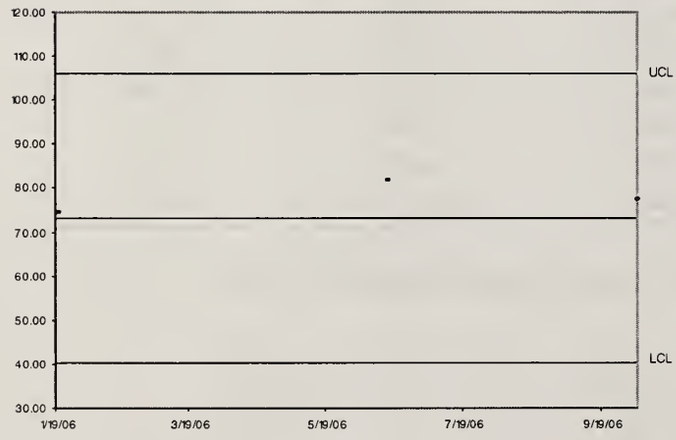
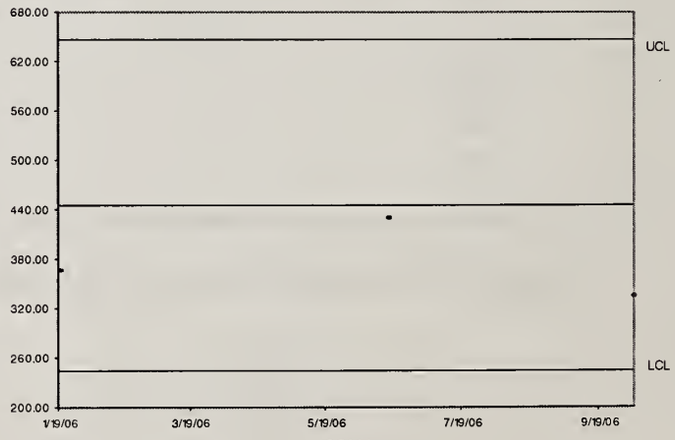


SO201



SO201

SULPHATE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/1982
Method Reference No.	E3172	Reporting Unit	mg/L as SO_4
LIMS Product Code	SULP3172, Anion3172	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Surface Water, Ground Water, Leachates, Effluent, Industrial Waste, Raw Sewage		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Sulphate is separated from other anions in the samples by automated suppressed ion chromatography using an eluent mixture of 0.001 M sodium bicarbonate and 0.0035 M sodium carbonate with conductivity detection. The concentration of sulphate in mg/L as SO_4 is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system with gradient flow control module and a conductivity detector. The software is Chameleon version 6.60.

REPORTING:

Max. Significant Figures: 3	Current W value: 0.5	Current T value: 2.5	Full Scale: 100.0 mg/L

CALIBRATION:

BL plus 9 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	CHK1 and CHK2 standard approximately every 20 samples

SULPHATE (E3172)

QUALITY CONTROL DATA FROM 01/05/06 TO 12/19/06

Analytical Range: to 100.0 mg/L as SO4

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	44	80.0	79.99	-0.01	0.46
B	44	40.0	40.30	0.30	0.32
C	44	8.0	8.18	0.18	0.23
A + B	44	120.0	120.29	0.29	0.65
A - B	44	40.0	39.69	-0.31	0.45
B + C	44	48.0	48.48	0.48	0.40
B - C	44	32.0	32.12	0.12	0.40

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between/Within	0.40
	Within Runs	0.32
	Between/Within	1.24
s.d.(BC)	Between Runs	0.28
	Within Runs	0.28
	Between/Within	1.00

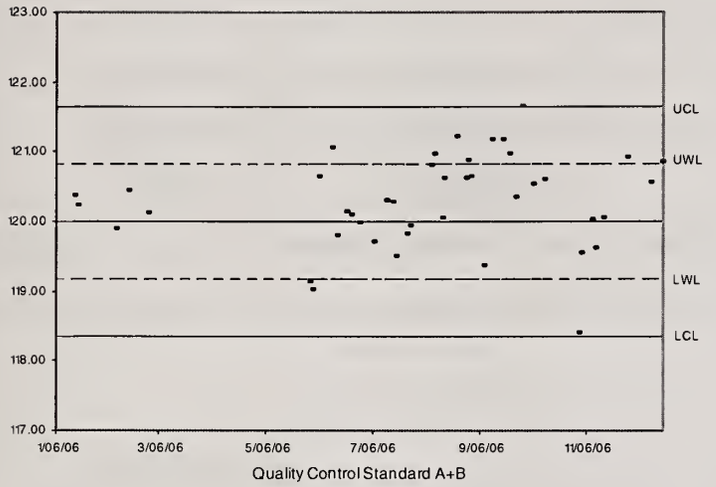
Control Limits:

Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	119.175	120.825	118.35	121.65
A - B	39.177	40.823	38.76	41.24
B + C	47.475	48.525	46.95	49.02
B - C	31.47	32.53	31.21	32.79

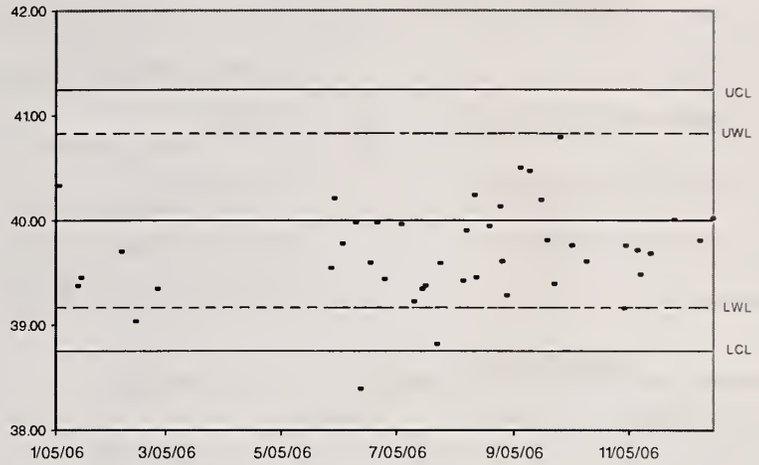
Duplicates:

Number	Concentration	Std. Dev.	% Coeff of Var
22	0.0 - 10.0	0.1468	3.3
28	10.1 - 20.0	0.3419	2.3
57	20.1 - 50.0	0.3519	1.1
12	50.1 - 100.0	0.4853	0.7
119	Total	1.0658	4.1

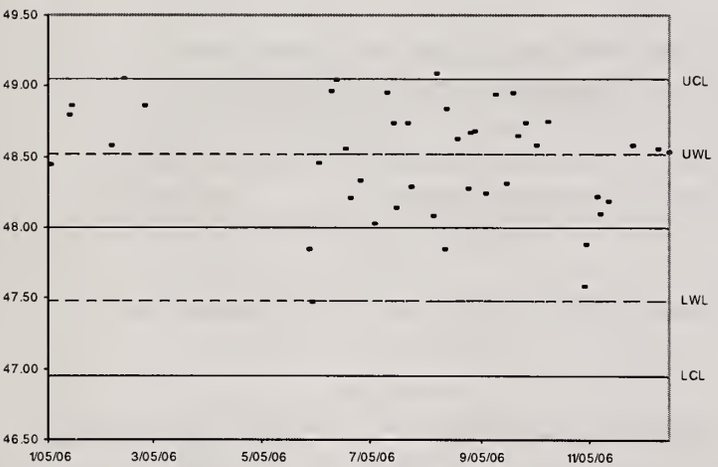
SULPHATE (E3172)
QUALITY CONTROL DATA FROM 01/05/06 TO 12/19/06
Analytical range to 100.0 mg/L



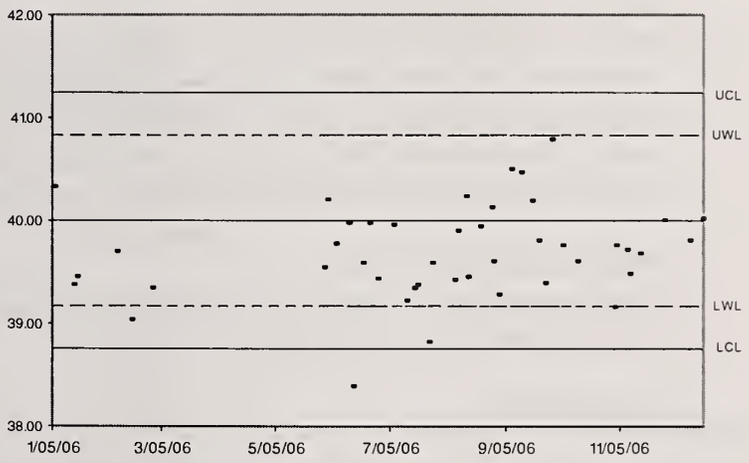
Quality Control Standard A+B



Quality Control Standard A- B



Quality Control Standard B+C



Quality Control Standard A- B

SULPHIDE

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	June 89
Method Reference No.	E3100	Reporting Unit	□g/L as S^{2-}
LIMS Product Code	H2S3100	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Surface Water, Ground Water, Leachates, Effluent, Industrial Waste, Raw Sewage		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic
Preservative(s)	None

ANALYTICAL PROCEDURE:

Total Sulphide including H_2S, HS^- and any acid soluble metal sulphides which have been precipitated as ZnS during sample preservation. The precipitated sulphides (hydrogen sulphides) are dissolved in an alkaline absorbing solution and reacted with N,N-dimethyl-p-phenylenediamine dihydrochloride and ferric chloride to form methylene blue. The intensity of the methylene blue is compared to standards treated in the same manner.

INSTRUMENTATION:

Basic automated modular continuous flow colourimetric system, measurement through a 660 nm filter and a 50 mm flow cell (1.5mm ID).

REPORTING:

Max. Significant Figures: 3	Current W value: 2.0 µg/L	Current T value: 10.0 µg/L	Full Scale: 160.0 µg/L

CALIBRATION:

BL plus 5 standards

CONTROLS:

Calibration	Daily blank and 3 standards, e.g. QCA
Drift	Blank and sensitivity check standard approximately every 10 samples

SULPHIDE (E3100)

Analytical Range: to 160.0 µg/L as S

Calibration Control:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	14	128	120.501	-7.499	7.895
B	14	80	80.724	0.724	4.453
C	14	32	34.966	2.966	3.525
A + B		208	201.224	-6.776	9.737
A - B		48	39.777	-8.223	8.337
B + C		112	115.689	3.689	6.684
B - C		48	45.758	-2.242	4.454

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	6.4092
	Within Runs	5.8951
	Between/Within	1.09
s.d.(BC)	Between Runs	4.016
	Within Runs	3.1495
	Between/Within	1.28

Control Limits:

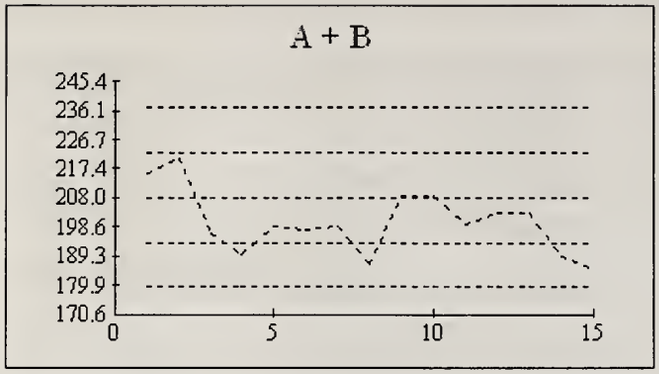
Control Standard	Warning Limits		Control Limits	
	Lower	Upper	Lower	Upper
A + B	191.6	224. 4	179.2	236.8
A - B	31.6	64. 4	226.4	69.9
B + C	87.15	136.85	62.3	161.7
B - C	23.15	72.85	10.7	85.3

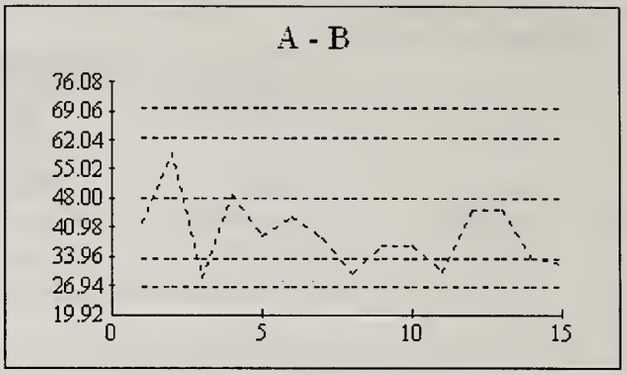
Duplicates:

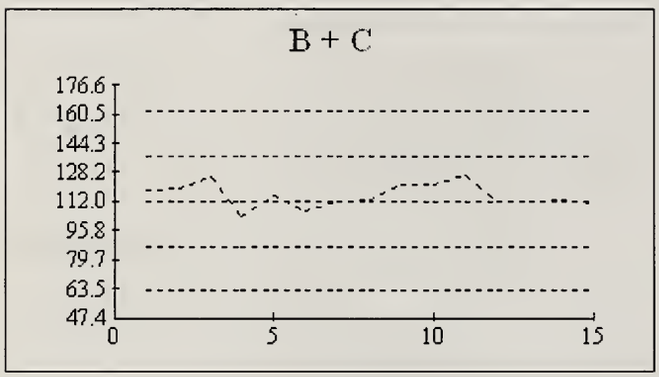
Number	Concentration	Std. Dev.	% Coeff of Var
23	0 - 10%	5.755	157.823
1	10 - 20%	N/A	N/A
5	20 - 50%	12.126	18.827
3	50 - 100%	10.558	8.349
32	Total	7.567	30.171

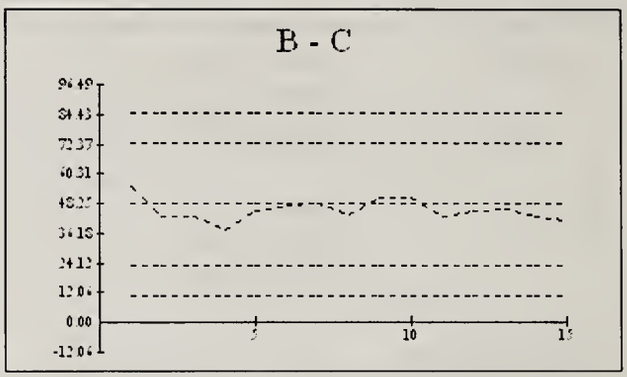
Sulphide (E3100)

QC Data; 1/1/2006 to 12/31/2006









TURBIDITY

CCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

ENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before'74
Method Reference No.	E3311	Reporting Unit	FTU
LIMS Product Code	TURB3311	Supervisor	P. Wilson
Sample Type/Matrix	Surface Water, Ground Water, Effluent, Drinking Water, Industrial Waste, Process Water, Leachate		

MPLING:

Quantity Required:	50 mL
Container:	Glass or plastic
Preservative(s)	None

ALYTICAL PROCEDURE:

ne instrument is standardized with sealed standards which are prepared commercially and are rated in ormazin Turbidity Units. Samples are placed in the turbidimeter, and results in FTU are read directly om the digital output. Turbidity measurements are based on light scattering at 90° (±30°) rotation. The strument compensates for sample colour.

STRUMENTATION:

Hach Ratio/XR Model Turbidimeter modified to accept control signals from robot controller, electronic terface, Zymark ZYMATE 11 Laboratory Robot System and computer.

PORTING:

Max. Significant Figures: 3	Current W value: 0.05	Current T value: 0.25	Full Scale: 2000 FTU

LIBRATION:

L plus formazin standards (once every four months). Calculated QC limits are specific to each standard et.

TURBIDITY cont'd

CONTROLS:

Calibration:	5 standards, e.g. QCA

NOTES:

QCA and QCD data for June 4th and 18th are outside the limits respectively. Samples were repeated in their respective range.

TURBIDITY (E3311)

QUALITY CONTROL DATA FROM 01/06/06 TO 12/21/06
Analytical Range: to 2000 FTU

CALIBRATION CONTROL:

		n	Expected Concentration	Mean Concentration	Standard Deviation
A:	Jan	3	2.0	1.4647	0.0025
	Jan - Feb	7		1.3584	0.0043
	June - July	28		1.3694	0.0229
	July - Dec	81		1.368	0.0154
	Nov - Dec	8		1.3358	0.0233
B:	Jan	3	20.0	16.527	0.0461
	Jan - Feb	7		16.093	0.1697
	June - July	28		16.461	0.2232
	July - Dec	81		16.717	0.1375
	Nov - Dec	8		16.775	0.2435
C:	Jan	3	200.0	145.83	0.5033
	Jan - Feb	7		146.97	0.8139
	June - July	28		147.61	0.8545
	July - Dec	81		147.91	0.7757
	Nov - Dec	8		152.88	1.126
D:	Jan	3	2000.0	1512.67	3.7859
	Jan - Feb	7		1545.14	6.7436
	June - July	28		1509.63	13.9481
	July - Dec	81		1494.62	5.7719
	Nov - Dec	8		1445.38	41.761

On any given day the calibration is accepted if the values obtained lie with in the ranges:

1.576	-	1.462	for	A (Jan)
1.571	-	1.422		A (Jan - Mar)
1.510	-	1.433		A (Mar - June)
1.479	-	1.338		A (June - July)
1.507	-	1.379		A (July - Sep)
1.539	-	1.392		A (Sep - Oct)
1.500	-	1.436		A (Oct - Dec)
17.46	-	16.36	for	B (Jan)
17.64	-	15.96		B (Jan - Mar)
17.01	-	16.03		B (Mar - June)
16.85	-	15.24		B (June - July)
17.18	-	15.54		B (July - Sep)
17.20	-	15.56		B (Sep - Oct)
16.69	-	16.10		B (Oct - Dec)
152.2	-	146.1	for	C (Jan)
156.3	-	141.4		C (Jan - Mar)
150.0	-	143.9		C (Mar - June)
153.4	-	138.8		C (June - July)
154.2	-	142.0		C (July - Sep)
153.0	-	138.5		C (Sep - Oct)
147.1	-	142.7		C (Oct - Dec)
1537	-	1501	for	D (Jan)
1637	-	1481		D (Jan - Mar)
1568	-	1515		D (Mar - June)
1607	-	1454		D (June - July)
1555	-	1501		D (July - Sep)
1596	-	1444		D (Sep - Oct)
1532	-	1493		D (Oct - Dec)

	N	Data Mean	Std. Dev. (1)
Stray Light	127	0.00423	0.0163

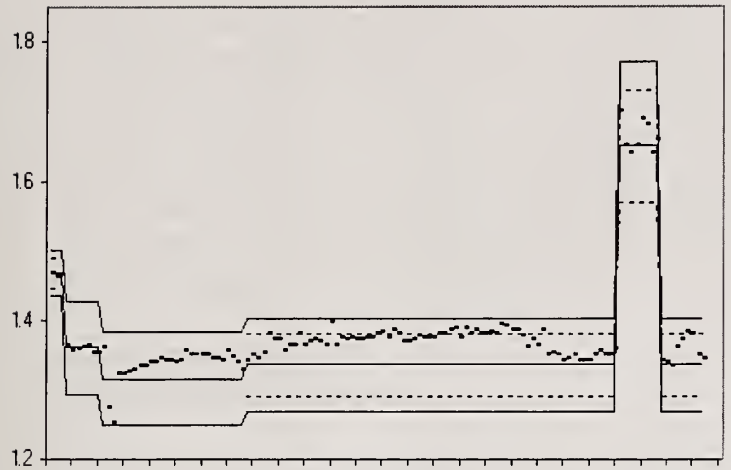
DUPLICATES:

Number od Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of Variation (%)
109	0.0 - 2.0	0.0557	6.6
168	2.1 - 20.0	0.3922	5.1
80	21.0 - 200	1.2320	1.8
8	201 - 2000	8.6096	1.5
364	Overall	1.4264	4.5

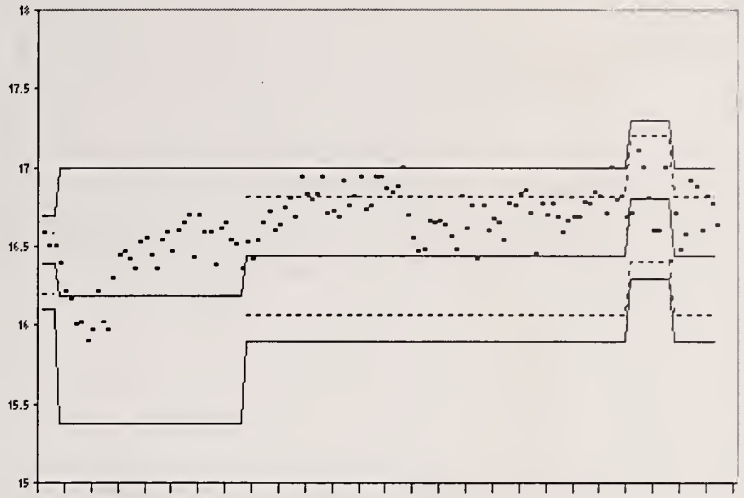
TURBIDITY (E3311)

QUALITY CONTROL DATA FROM 01/05/06 TO 12/23/06

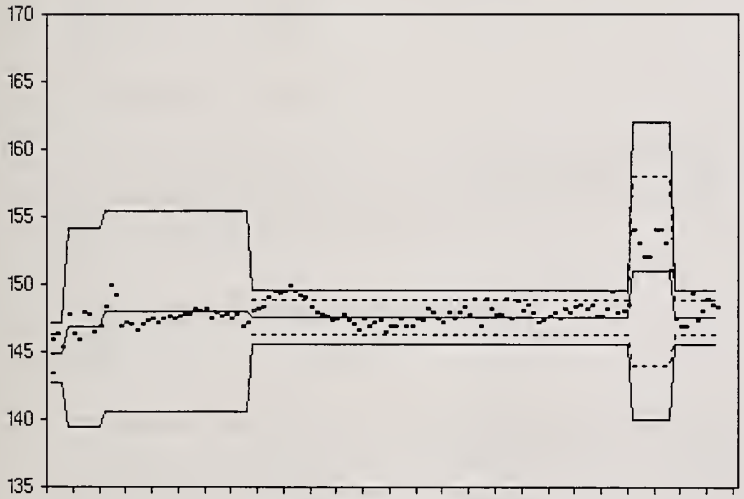
Analytical Range: to 2000 FTU



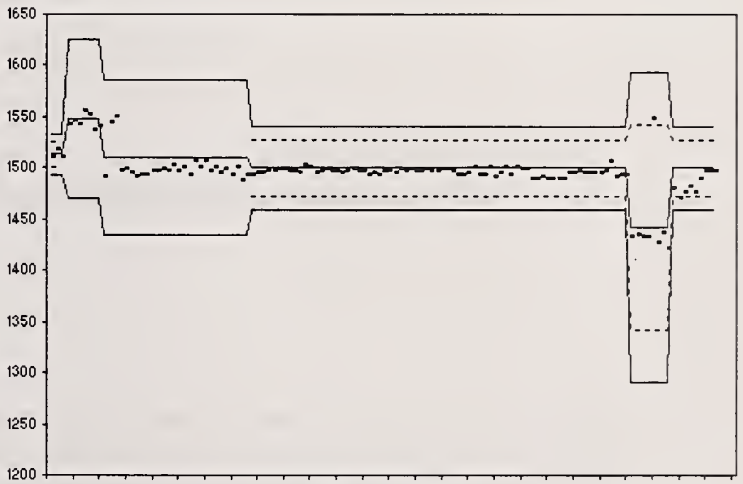
Quality Control Standard A



Quality Control Standard B



Quality Control Standard C



Quality Control Standard D

PART 3.0

MICROBIOLOGY

3.1 Quality Control Program, Microbiology Unit

Performance Criteria

Analyses of samples in the Microbiology Unit are performed using validated and accredited (SCC) methodologies, by trained technologists. Quality control measures have been incorporated into the methodologies to ensure that all analytical procedures are functioning properly, minimizing the potential to identify and report false positive or negative results. This report focuses on the quality control implemented during sample analyses. Information regarding the implementation of quality control procedures for sample containers, monitoring of the Pure Water supply, media preparation and storage, equipment monitoring are described by the Laboratory Services Branch Standard Operating Procedure (SOPs) (4) and Microbiology Unit Standard Operating Procedures (SOPs), approved Microbiology Methods and Lab Services Branch Quality Assurance Manual (2).

Membrane Filtration

Blank Control Analyses

A control (sterile buffered dilution water) sample is processed between each sample analyzed. The control sample is processed in a manner similar to the regular sample including volume, agar used, incubation time and temperature. The blank control should remain free of any bacterial growth.

Duplicate Analyses

At least one sample in 10 is analyzed in duplicate per day. The data is accumulated for each parameter and a “within-run” standard deviation is calculated to give a measure of the repeatability of the results.

Presence-Absence Procedure

Blank Control Analyses

At least one sample in 10 samples per day includes a blank control sample prepared by adding a 99 mL dilution blank (sterile, buffered dilution water) to P-A broth and incubating it along with the regular P-A bottles. The blank control should remain free of any bacterial growth and there should be no change in the colour of the broth. Identification of growth or colour change in the control blank requires follow-up of sterility checks in both the P-A broth and the dilution blanks.

Heterotrophic Spread Plate

Blank Control Analyses

At lease one sample in 10 samples is analyzed per day includes inoculating a Plate Count agar plate with 0.1 mL of sterile buffered dilution water and incubating it along with the regular Plate Count agar plates (35.0±0.5°C, 48±3 hours).

Duplicate Analyses

At least one sample in 10 samples is analyzed in duplicate per day. The data is accumulated for each parameter and a “within-run” standard deviation is calculated to give a measure of the repeatability of the results.

Blank Analyses Corrective Action

The presence of bacterial growth on any control sample by the above techniques (Membrane Filtration, PA Broth, Heterotrophic Spread Plate) indicates absence of aseptic technique. The supervisor must be consulted with regards to determining follow-up and corrective action. Reporting of results may be tempered by the presence of bacterial growth on these control samples and data qualifying remarks codes would be noted on the final report. Records of all control samples are maintained in the laboratory.

3.2 PERFORMANCE SUMMARIES

MICROBIOLOGY

Bacillus thuringiensis israelensis (*Bti*)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2004
Method Reference No.	E3451	Reporting Unit	CFU/100 mL
LIMS Product Code	BTI3451	Scientist	A. Irwin Abbey
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	250mL
Container:	Bacti bottles
Preservative:	sodium thiosulphate

ANALYTICAL PROCEDURE:

A 100 mL volume from each sample is filtered through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto Brain Heart Infusion (BFI) agar plate and incubated 28.5±0.5°C, for 20±3 hours. Target colonies (clear) formed on the membrane filter are asceptically transferred to 100 µL of molecular water where they are boiled at 100.0±5.0°C for 10±3 minutes followed by centrifugation at 10,000xg for 10 minutes. A 1 µL volume of this sample is added to 24 µL master mix and these samples are then run in a polymerase chain reaction (PCR). Samples exhibiting positive results through PCR are confirmed using gel electrophoresis.

INSTRUMENTATION:

ABI Prism® 7900HT Sequence Detection System, biological safety cabinet, bunsen burner, centrifuges, centrifuge tubes (sterile), DNA preparation hood, filtration assembly, freezers and refrigerators, graduated cylinders (sterile), heatblock, incubators, loop, membrane filters (sterile), microscope, microwave, 96 well optical reaction plates, PCR mix preparation hood, pipetting devices, pipetting tips, thermocycler, vortex.

REPORTING:

Max. Significant Figures: 2	Current W value: 0	Current T value: N/A	Full Scale: CFU/100mL

Bacillus thuringiensis israelensis (*Bti*) cont'd

CONTROLS:

Analytical	Duplicate samples Blank filter between samples Negative and positive control samples with each PCR and gel electrophoresis run

Bacillus thuringiensis israelensis (*Bti*) (E3451)
Analytical Range: CFU/100 mL

Membrane Filtration Analyst Duplicates:

Counts per plate	Mean (data)	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
all data	12.08	5.17	12.00	4.28	35.44

Membrane Filtration Method Duplicates:

Counts per plate	Mean (data)	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
all data	11.37	9.28	88.00	8.43	74.10

Polymerase Chain Reaction Analyst Duplicates:

Ct	Mean (data)	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
all data	29.65	1.01	37.00	1.18	3.99

Polymerase Chain Reaction Method Duplicates:

Ct	Mean (data)	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
all data	26.64	2.22	246.00	3.07	11.52
<30	27.18	1.93	199.00	1.97	7.23
>30	34.46	1.62	44.00	1.43	4.15

Bacillus thuringiensis israelensis (*Bti*)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): No
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2004
Method Reference No.	E3452	Reporting Unit	Total Bti / 100 mL
LIMS Product Code	BTI3452	Scientist	S. Weir
Sample Type/Matrix	Drinking Water (WD), Surface Water (WS), or Ground Water (WG)		

SAMPLING:

Quantity Required:	250mL
Container:	Bacti bottles
Preservative:	none required (may contain sodium thiosulphate)

ANALYTICAL PROCEDURE:

A 100 mL volume from each sample is filtered through a 0.45 µm pore size, cellulose filter, and aeseptically removed from the filtration apparatus. DNA is directly extracted from this filter. A 10 µL volume of this DNA extract is added to 15 µL of Master Mix and 1 µL of an internal plasmid probe. These samples are then run using Real-time polymerase chain reaction (PCR) to determine if there are any inhibitors present in the sample that would hinder amplification. If there are inhibitors, samples undergo dilution and, if necessary, a purification step and the above is repeated. If no inhibition is present, a 10 µL volume of the DNA extract is added to 15 µL of Master Mix and samples are run using Real-time PCR. Samples are quantified using a standard curve of calibrated plasmids that are run concurrently.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, bunsen burner, microscope, biological safety cabinet, ABI Prism 7900HT Sequence Detection System, centrifuges, PCR mix preparation hood, DNA preparation hood, thermocycler, vortex, sterile centrifuge tubes, 96 well optical reaction plates, pipetting devices, pipetting tips, freezers and refrigerators.

REPORTING:

Max. Significant Figures: 2	Current W value: < 60	Current T value: N/A	Full Scale: 100 mL

CONTROLS:

Analytical	Duplicate samples Blank filter between samples Negative and positive control samples with each PCR

***Bacillus thuringiensis israelensis* (*Bti*)** (E3452)
Total *Bti* / 100 mL

QUALITY CONTROL DATA FOR 2004 & 2005

DUPLICATES:

Counts per plate	Mean of data (Log transformed)	Mean Difference (Log transformed)	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
Spiked SuperQ Water	2.96	0.25	31	0.26	8.78
Spiked Raw Water	3.35	0.21	11	0.23	6.87

Cryptosporidium parvum and *Cryptosporidium hominis*

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2006
Method Reference No.	E3463	Reporting Unit	Total *Cryptosporidium*/ 100 mL
LIMS Product Code	CRYPTO3463	Scientist	S. Weir
Sample Type/Matrix	Trade Effluent (TE), used for abattoir samples		

SAMPLING:

Quantity Required:	250mL
Container:	Bacti bottles
Preservative:	none required (may contain sodium thiosulphate)

ANALYTICAL PROCEDURE:

A 100 mL volume from each sample is aseptically transferred to a tissue culture tube and centrifuged for 30 min. The sample is decanted, resuspended into water and transferred into an L10 tube. *Cryptosporidium* is extracted from the sample using immunomagnetic separation (IMS). DNA is directly extracted and purified using a liquid nitrogen freeze thaw procedure followed by a QIAGEN QIAvac24 kit. A 10 µL volume of this DNA extract is added to 15 µL of master mix and 1 µL of an internal plasmid probe. These samples are then run using Real-time polymerase chain reaction (PCR) to determine if there are any inhibitors present in the sample that would hinder amplification. If there are inhibitors, samples undergo dilution and, if necessary, a purification step and the above are repeated. If no inhibition is present, a 10 µL volume of the DNA extract is added to 15 µL of master mix and samples are run using Real-time PCR. Samples are quantified using a standard curve of calibrated plasmids that are run concurrently.

INSTRUMENTATION:

ABI Prism®7900HT Sequence Detection System, bunsen burner, biological safety cabinet, centrifuges, centrifuge tubes (sterile), culture tubes (sterile), DNA preparation hood, Dynal biotech sample mixer, freezers and refrigerators, graduated cylinders (sterile), liquid nitrogen bath, 96 well optical reaction plates, PCR mix preparation hood, pipetting devices, pipetting tips, QIAvac vacuum24 manifold and luer caps, thermocycler, vortex, waterbath.

REPORTING:

Max. Significant Figures: 2	Current W value: < 10	Current T value: N/A	Full Scale: 100 mL

CONTROLS:

Analytical	Duplicate samples Blank filter between samples Negative and positive control samples with each PCR

Cryptosporidium parvum and *Cryptosporidium hominis*
E3463
QUALITY CONTROL DATA FOR 2006
Total C*ryptosporidium*/100 mL

Method Duplicates:

	Quantity/ 100mL	Mean Data (log)	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
Abattoir Water	all data	3.20	0.19	12.00	0.15	1.50

Analyst Duplicates:

	Quantity/ 100mL	Mean Data (log)	Mean Difference	n (duplicate pairs)	Sdv (duplicates)	Coefficient of Variation
Super Q Water	all data	3.52	0.16	17.00	0.18	5.19
	> 10,000	3.73	0.15	14.00	0.18	4.90
	1,000-9,999	3.43	0.18	10.00	0.21	6.15
	<999	2.53	0.21	3.00	0.18	7.24
Abattoir	all data	3.24	0.15	22.00	0.15	4.55
	> 10,000	4.19	0.07	2.00	0.07	1.56
	1,000-9,999	3.53	0.10	16.00	0.09	2.48
	Under 999	2.48	0.29	6.00	0.24	9.83

Escherichia coli (EC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): Detected/Present

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth, incubated (35.0±0.5°C, for up to 48±3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for Escherichia coli are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators, UV lamp

REPORTING:

Present / Absent per 100 mL

CONTROLS:

Analytical	Negative Control(5% per day) -Sterile buffered dilution water

NOTES:

*PA3226 is used for the detection of EC and TC. Confirmatory testing using ECMug is required.

Escherichia coli (EC)

E3226
QUALITY CONTROL DATA FOR 2006

Present/Absent per 100 mL

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	553	0

Escherichia coli (EC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): >0 CFU

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	EC3371, *TC**EC**3371,****EC**FS3371 *,**EC**FSPS3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto MFC-BCIG agar plate and incubated 44.5±0.5°C, 24±2 hours. Target colonies (blue) formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

* TCEC3371,*ECFS3371*,ECFSPS3371 are mixed parameter product codes. See individual tests TC,FS,PSA, for details on medium used and incubation.

***Escherichia coli* (EC)**
E3371
QUALITY CONTROL DATA FOR 2006
CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation	Coefficient of Variation (%)
307	0-19*	1.43	1.63	40.37
97	20-80	5.10	4.35	10.61
31	81-150	7.65	6.36	6.36

*101 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	2302	3

Escherichia coli (EC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): >0 CFU

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3407	Reporting Unit	CFU per 100mL
LIMS Product Code	*TC**EC**3407	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto DC agar plate and incubated 35.0±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, bunsen burner, incubator, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

*TCEC3407 is a mixed parameter product code. The same medium and incubation time are used to determine both parameters TC and EC.

***Escherichia coli* (EC)**
E3407
QUALITY CONTROL DATA FOR 2006
CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
10	0-19*	0.2	0.32	158.11
12	20-80	5.83	5.10	9.19
2	81-150	4.5	3.20	3.16

*8 duplicates pairs with counts per filter of zero each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	113	0

Escherichia coli (EC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): N/A
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	2004
Method Reference No.	E3433	Reporting Unit	CFU /g wet weight
LIMS Product Code	EC3433	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage		

SAMPLING:

Quantity Required:	50g
Container:	WhirlPak™ bag
Preservative:	None

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto MFC-BCIG agar plate and incubated 44.5±0.5°C, 24±2 hours. Target colonies (blue) formed on the membrane filter are recorded per gram wet weight of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

***Escherichia coli* (EC)**
E3433
QUALITY CONTROL DATA FOR 2006
CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
3	0-19*	1.0	0.91	78.25
N.A.	20-80	N.A.	N.A.	N.A.
N.A.	81-150	N.A.	N.A.	N.A.

*1 duplicates pairs with counts per filter of zero each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	6	0

Fecal Streptococci (FS)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): >0 CFU

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	FS3371,*EC**FS**3371, *EC**FS**PS3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mEnterococcus agar plate and incubated 35±0.5°C, 48±3 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

ECFS3371, ECFSPS3371 are mixed parameter product codes. See individual tests EC, PSA, for details on medium used and incubation.

Fecal Streptococci (FS)
E3371
QUALITY CONTROL DATA FOR 2006
CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
118	0-19*	1.84	1.80	29.90
59	20-80	3.80	3.41	7.88
23	81-150	7.09	6.21	5.74

*15 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	866	2

Heterotrophic Plate Count (HPC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): N/A

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3408	Reporting Unit	CFU per 1mL
LIMS Product Code	PC3408	Scientist	R. Schop
Sample Type/Matrix	Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquot is inoculated onto a Plate Count agar plate with a micropipette. The sample is then spread onto the plate using a glass rod and an electronic turntable. The plate is then incubated 35.0±0.5°C, 48±3 hours and checked for growth. Target colonies formed on the plate are recorded per 1 mL of sample

INSTRUMENTATION:

Micropipette, sterile micropipette tips, sterile glass rod, electronic turntable, incubator, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicates Negative control per run- open air plate Negative control (5% per day) - glass rod check

NOTES:

No longer reporting exceedances on heterotrphic bacteria >500 CFU/mL. Drinking water limit on heterotrphic plate count (general bacteria) changed in O.Reg.163/03, Sched. 1; Reg. 248/06, s.1, June, 2006.

Heterotrophic Plate Count (HPC)
E3408
QUALITY CONTROL DATA FOR 2006
CFU/mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
197	0-19*	0.22	0.50	64.33
31	20-80	4.97	4.17	10.43
6	81-150	10.8	9.86	8.62

*167 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	414	0

INDICATOR ORGANISMS

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No ____	Reportable Limit (OSDWA): Present/Detected

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth and incubated (35±0.5°C, for up to 48±3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for indicator organisms are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators

REPORTING:

Detected/Not Detected per 100 mL

CONTROLS:

Analytical	Negative Control -Sterile buffered dilution water

NOTES:

*PA3226 is used for the detection of indicator organisms. Various media are used in their determinations . See method.

Indicator Organisms
E3226
QUALITY CONTROL DATA FOR 2006
Present/Absent per 100 mL

	n	Number of Confirmed Indicator Organisms
Presumptive Positive	50	25

Pseudomonas aeruginosa (PSA)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No _____	Reportable Limit (OSDWA): >0 CFU

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	PSA3371,*ECFS**PS**3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mPA agar plate and incubated 41.5±0.5°C, 48±3 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

*ECFSPS3371 is a mixed parameter product code. See individual test EC, FS for details on medium used and incubation.

***Pseudomonas aeruginosa* (PSA)**
E3371
QUALITY CONTROL DATA FOR 2006
CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
71	0-19*	0.73	0.95	38.52
19	201-80	5.37	4.51	11.28
2	81-150	13.00	11.18	10.03

* 33 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	447	2

Total Coliforms (TC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No ____	Reportable Limit (OSDWA): Present/Detected

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth and incubated (35±0.5°C, for up to 48±3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for Total Coliforms are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators, UV lamp

REPORTING:

Present / Absent per 100 mL

CONTROLS:

Analytical	Negative Control -Sterile buffered dilution water

NOTES:

*PA3226 is used for the detection of EC and TC. Confirmatory testing using ECMug is required.

Total Coliforms (TC)
E3226
QUALITY CONTROL DATA FOR 2006
Present/Absent per 100 mL

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	553	0

Total Coliforms (TC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No ____	Reportable Limit (OSDWA): >0 CFU

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	TC3371, *TCEC3371	Scientist	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mEndo LES agar plate and incubated 35.0±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter.

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

* TCEC3371 is a mixed parameter product code. See individual test (EC) for details on medium used and incubation.

Total Coliforms (TC)
E3371
QUALITY CONTROL DATA FOR 2006
CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
N.A.	0-19	N.A.	N.A.	N.A.
21	20-80	5.86	5.11	10.19
4	81-150	6.00	4.92	4.12

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	2302	0

Total Coliforms (TC)

ACCREDITATION & DRINKING-WATER LICENSING STATUS

Accreditation Status:	Licensed (Drinking Water): ☑
Yes _☑_ No ____	Reportable Limit (OSDWA): >0 CFU

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3407	Reporting Unit	CFU per 100mL
LIMS Product Code	***TC**EC3407	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto DC agar plate and incubated 35.0±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, bunsen burner, incubator, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable

CONTROLS:

Analytical	Duplicate samples Blank filter between samples

NOTES:

*TCEC3407 is a mixed parameter product code. The same medium and incubation time are used to determine both parameters TC and EC.

Total Coliforms (TC)
E3407
QUALITY CONTROL DATA FOR 2006
CFU/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate	Mean Difference	Standard Deviation	Coefficient of Variation (%)
9	0-19*	0.44	0.75	134.16
14	20-80	6.64	5.59	9.99
7	81-150	12.57	10.25	9.87

* 7 duplicates pairs with counts per filter of zero on each.

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	113	0

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ABBREVIATIONS

AAII	- Auto Analyzer Model II
AAS	- Atomic Absorption Spectrophotometer
Bl	- Blank
°C	- Degree Centigrade
cm	- Centimetre
CS1	- Check Sample 1
CS2	- Check Sample 2
CFU	- Colony Forming Units
Date	- Day/Month/YEar
DO	- Dissolved Oxygen
EDTA	- Ethylenediaminetetra-Acetic Acid, Disodium Salt, Dihydrate
FTU	- Formazin Turbidity Units
g	- Gram
HZU	- Hazen Units
in^2	- Square Inches
IS(n)	- Internal Standard (n denotes parameter)
kg	- kilogram
L	- Litre
LAB	- Laboratory
LIMS	- Laboratory Information Management System
LTB/L	- Long Term Blank
lcl	- Low Control Limit
lwl	- Low Warning Limit
m^3	- Cubic Metre
M	- Molarity
MB	- Method Blank
meq	- Milliequivalent
mg	- Milligram
min	- Minute
mL	- Millilitre
mm	- Millimetre
N	- Normality
N.A.	- Not Available or Not Applicable
nm	- Nanometre
n	- Number
OSDWA	- Ontario Safe Drinking Water Act, 2002

ABBREVIATIONS cont'd

PC	- Personal Computer
Pure-DW	- Pure Deionized Water
Pure-W	- Pure Water
QC	- Quality Control
QCA	- Quality Control Standard A
QCB	- Quality Control Standard B
QCC	- Quality Control Standard C
QCD	- Quality Control Standard D
R	- Recovery
rpm	- Revolutions Per Minute
RS92	- Reference Standard (in -house)
S	- Between Run Standard Deviation
S_1	- Standard Deviation (Conventional)
S_2	- Standard Deviation For Duplicates
S_w	- Standard Deviation Within Run
S. Class	- Weight Classification Designation (not certified)
s.d.	- Standard Deviation
Standard Cal	- Colourimeter setting to control electronic expansion
STD	- Standard
TCU	- True Colour Units
TPTZ	- Ferrous-2,4,6-tri(2'pyridyl)-1,3,5,- triazine
ucl	- Upper Control Limit
uwl	- Upper Warning Limit
µm	- Micrometer
µeq	- Microequivalent
µg	- Microgram
µS	- Micro-Siemen
µL	- Microlitre
UV	- Ultra-Violet
V/V	- Concentration based on volume measurements
W40	- Whatman 40 Filters
%	- Percent

Appendix A
W and T values for 2006-

Parameter	Method Reference No.	Units	Full Scale	W	T
Alkalinity, Total Fixed Endpoint	(E3218)	mg/L $CaCO_3$	1000	0.5	2.5
Bromate	(E3434)	µg/L BrO_3	30	0.2	1.0
Bromide	(E3434)	µg/L Br	300	0.2	1.0
Carbon, Dissolved Inorganic	(E3370)	mg/L C	80.0	0.2	1.0
Carbon, Dissolved Organic	(E3370)	mg/L C	20.0	0.1	0.5
Chloride	(E3004)	µg/m^3 Cl	28.6	0.1	0.5
Chloride	(E3013)	µg/g Cl	1000	0.5	2.5
Chloride	(E3016)	mg/L Cl	100	0.2	1.0
Chlorophyll "a"	(E3169)	µg/L	-	0.2	1.0
Chlorophyll "a" Acidified	(E3169)	µg/L	-	1.0	5.0
Chlorophyll "b"	(E3169)	µg/L	-	0.1	0.5
Colour, True	(E3219)	TCU	100	0.2	1.0
Conductivity	(E3218)	µS/cm	2000	1	5
Cyanide, Free	(E3015)	mg/L CN^-	0.2	0.001	0.005
		µg/g CN^-		0.01	0.05
Cyanide, Total	(E3015)	mg/L CN^-	0.2	0.001	0.005
Cyanide, Total	(E3015)	µg/g CN^-		0.01	0.05
Fluoride	(E3172)	mg/L F	2.0	0.01	0.05
Nitrate	(E3004)	µg/m^3 NO_3	28.6	0.1	0.5
Nitrilotriacetic Acid	(E3406)	mg/L NTA	1.00	0.01	0.05
Nitrogen, Ammonia Plus Ammonium	(E3364)	mg/L N	2.0	0.002	0.01

Ammonia Plus Ammonium	(E3366)	mg/L N	50.0	0.05	0.25
Nitrogen, Nitrate Plus Nitrite	(E3364)	mg/L N	12.008	0.005	0.025
Nitrogen, Nitrate Plus Nitrite	(E3366)	mg/L N	50.0	0.05	0.25
Nitrogen, Nitrite	(E3364)	mg/L N	0.200	0.001	0.005
Nitrogen, Nitrite	(E3366)	mg/L N	2.00	0.005	0.025
Nitrogen, Total Kjeldahl	(E3116)	mg/g N	20	0.1	0.5
Nitrogen, Total Kjeldahl	(E3367)	mg/L N	2.00	0.02	0.10
Nitrogen, Total Kjeldahl	(E3368)	mg/L N	50.0	0.05	0.25
Oxygen Demand, Biochemical	(E3182)	mg/L O	9.0	0.2	1
Oxygen Demand, Chemical	(E3170)	mg/L O	50	1	5
Oxygen Demand, Chemical	(E3246)	mg/L O	400	2	10
pH	(E3218)	-	-	-	-
Phenolics, Reactive	(E3179)	µg/L Phenol	50.0	0.2	1.0
Phosphorus, Reactive ortho-Phosphate	(E3364)	mg/L P	0.100	0.0005	0.0025
Reactive ortho-Phosphate	(E3366)	mg/L P	10.0	0.02	0.10
Phosphorus, Total	(E3116)	mg/g P	2	0.02	0.10
Phosphorus, Total	(E3367)	mg/L P	0.200	0.002	0.01
Phosphorus, Total	(E3368)	mg/L P	10.0	0.02	0.10
Silicon, Reactive Silicates	(E3370)	mg/L Si	10.0	0.02	0.10
Solids, Dissolved	(E3188)	mg/L	-	10	50
Solids, Suspended	(E3188)	mg/L	-	0.5	2.5
Solids, Suspended Ignited	(E3188)	mg/L	-	0.5	2.5
Solids, Total	(E3188)	mg/L	-	10.0	50.0
Solids, Total Ignited	(E3188)	mg/L	-	10.0	50.0
Sulphate	(E3004)	µg/m^3 SO_4	28.6	0.1	0.5
Sulphate	(E3013)	µg/g	1000	0.5	2.5

Sulphate	(E3172)	mg/L SO_4	100	0.5	2.5
Sulphide	(E3100)	µg/L S^{2-}	100	2.0	10.0
Turbidity	(E3311)	FTU	2000	0.05	0.25

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